Onsite Disposal Systems and Potable Water Evaluations In The Sewee to Santee of Charleston County, South Carolina

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January 2006

This document was prepared with financial assistance provided to the Sewee to Santee Community Development Corporation, McClellanville by the National Environmental Services Center, National On-Site Demonstration Project Phase VII, National Small Flows Clearinghouse, West Virginia University, Morgantown, West Virginia, and the National Oceanic and Atmospheric Administration, U.S Department of Commerce under Grant NA170Z2352 to The South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management, Charleston.

ACKNOWLEDGEMENTS

Acknowledging that no work of this magnitude could be effectively completed without the input of others, the author would like to recognize the important contributions of agency personnel, community leaders, local representatives as well as individuals who have provided data, information, expertise, experience and encouragement invaluable to the execution and overall success of this project.

First, I would acknowledge the significant guidance and assistance of Clement Solomon and Graham Knowles of the National Small Flows Cleaning House, National Environmental Services Center, West Virginia University, Marian Page (South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (SCDHEC/OCRM), and Robert Britts (Southeast Rural Community Assistance Project) whose expertise and experiences have been notable throughout this project. I also acknowledge the invaluable insights of the Sewee to Santee Clean Water Committee members, and Leo Russo and Clay Duffy of Mount Pleasant Waterworks for their encouragement, input, guidance, and support all the way through the project.

The students of Lincoln High School, under the guidance of Principal Juanita Middleton, deserve special thanks for their hard work in conducting septic tank and water surveys of households in the Sewee to Santee: Derrick Alston, Herman Branton, Shantay Branton, Damien Dawson, India Ferguson, Joseph German, Jarvis Jamison, Courtney Smalls, G'Mesha Taylor, Rachel Threatt, Shonna Weston, Tiffani White, and Lakia Woodfield,

I acknowledge Deborah Seabrook, (formerly Executive Director of the Sewee to Santee Community Development Corporation [CDC]), Marcella Smalls (CDC) for her assistance and community insights, Lisa Hajjar (SCDHEC/OCRM), Stephen Caulk (SCDHEC), Christine Sanford-Coker and Gregory Sams (SCDHEC, Environmental Quality Control [EQC]), and Clifton Roberts (Clifton's Environmental Consultation Services) for their technical expertise and guidance, Danny Ackerman of A-1 Septic Tank Service for sharing considerable knowledge of his trade, Kelly Welch for conducting surveys, and Sharon Gilbert and Joan Hagan (DHEC/EQC) for overseeing the analyses and prompt reporting of over 300 bacteriological water samples. I also thank Wayne Fanning (DHEC/EQC) for providing timely and accurate information about water quality in northern Charleston County.

I acknowledge and appreciate the excellent organizational skills of Peter Smalls of Germantown in both engaging community leaders and local officials on the issues as well as garnering public interest and facilitating constructive dialogue in several public meetings.

Finally, I would like to thank the homeowners of the Sewee to Santee who answered our survey questions, and allowed us to inspect their septic systems and sample the water from their wells.

EXECUTIVE SUMMARY

This report was commissioned by the Sewee to Santee Community Development Corporation, South Carolina and prepared by Stephen Cofer-Shabica of Mt. Pleasant, South Carolina. The report's purpose is to describe and discuss investigations and research, on the status of the onsite wastewater disposal and potable water systems in the Sewee to Santee, northern Charleston County, South Carolina from Jenkins Hill Road to the South Santee River.

This Onsite Disposal System (OSDS) Evaluation Report addresses core issues and generates insights necessary to enable the Sewee to Santee Community Development Corporation to make appropriate decisions as it considers the development of onsite or decentralized wastewater management systems.

The mean lot size in the survey of 303 households was 2.86 acres, with the smallest lot, having a functional septic system, being 0.15 acres. Home ages ranged from less than one to 104 years with the mean age of all septic systems 28 years (range: 1 – 51). The mean number of household bedrooms and occupants was four and three, respectively. Fifty-seven percent of the septic tanks had never been inspected nor pumped. Over 22 percent of households pump their septic tanks at least once per year suggesting some problems with the system: leaky utilities resulting in water overload, system overload, or failed field lines. Seventeen percent of households had water softeners, and only three percent had garbage disposals. Thirty-eight percent of households had "grey-water" systems where the washing machine drain and at least one sink drain line were piped into the back or side yard or into a stormwater drainage ditch. This perhaps accounts for the large number of septic tanks that never required pumping or that had few repairs.

Twenty-one (7%) septic systems had been repaired during the previous fifteen years at an average cost of $810. Inspections and pump-outs were routinely carried out by 43% of homeowners with the time interval ranging from one to six years. The average pump-out cost was $131 but ranged up to $250. One septic system pumper routinely charges $100 to $125 in the Sewee to Santee. Tank sizes ranged from 400 to 1000 gallon homemade and commercial, with most being 1000 gallon commercial tanks. Most tanks had functional inlet and outlet Ts, but several had none or the Ts were damaged. Several systems had lids that were cracked and/or had portions missing.

The survey Results show that many homeowners understand the operation and care of their septic system. There are systems that need to be replaced, upgraded, or repaired. There is an urgent need to improve the potable water supply in the region by the installation of Point-of-Use Devices, the drilling of deeper individual, private wells, or the construction of community wells operated as a utility.

Soils were evaluated at forty-two sites throughout the Sewee to Santee. Twenty of the home-sites had soils that were "moderate" to "good" for septic tank use and support conventional or alternative septic tank systems. Eighteen sites were "limited," but would support alternative septic tank systems that might require extensive site modifications such as landscaping and fill material. Four home-sites had soils considered "severe" for septic tank use and would be considered unsuitable for septic tank placement or would require an innovative/experimental septic tank design.

The well water from 33% of the homes surveyed was contaminated with coliform bacteria and six of those wells were contaminated with health threatening fecal coliform bacteria.

Almost 70% of the members of the Sewee to Santee community surveyed favor the formation of a wastewater management entity for their community.

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Project Overview

1.1 Introduction

According to the Bureau of the Census (2001), the population in the coastal counties of the United States exceeds 141 million even though these areas account for only 17 percent of the total land mass. More than 180 million people visit the coast every year, and beaches are one of the largest vacation destinations in America. The coastal areas face a variety of major environmental problems, such as degraded water resources, shellfish bed closings, toxic contamination, and septic tank failure among others.

The Sewee to Santee Community Development Corporation, a non-profit organization, serves the residents of northeastern Charleston County. The rural population of this area, between the Sewee Road on the south, and the South Santee River on the north, is predominantly African American with 55% of the residents meeting poverty guidelines: 15% of these residents earn less than $10,000 annually (Census Bureau, 2001). The lack of industry and economic growth as well as remoteness of the Sewee to Santee region has not provided residents with opportunities for employment without having to drive at least twenty to thirty miles one way to work. Historically, this area of Charleston County is particularly significant as the majority of residents reside on heirs' property.

In the state of South Carolina, the Santee region is listed as one of the top twenty-five areas most in need of clean water and appropriate septic systems according to the South Carolina Department of Health and Environmental Control (Wayne Fanning, SCDHEC/EQC, *pers. comm.*). Environmentally, it is one of the last regions of pristine seacoast on the eastern seaboard (*www.stostourism.org)*. The area has a critical need for clean, safe potable as many of the residents have severely contaminated water systems. Residents are served by small, shallow private wells for their water needs. Yet, due to the high mineral content and bacteriological contaminants, many residents drive to either Georgetown or Mt. Pleasant to purchase potable water in one and five gallon containers for drinking (Peter Smalls, Germantown, *pers. comm*.); an expensive alternative for clean water. Indeed, several households have no indoor plumbing and rely on hand-pumps and out-houses in their yards for water and sanitation, respectively (Miriam Green, Berkeley Electric Cooperative, Awendaw, *pers. comm*.).

Septic systems or onsite wastewater disposal systems (OSDS) are effective methods for the treatment of wastewater in areas where municipal sewerage is not available, such as the Sewee to Santee. Septic systems are generally constructed on individual parcels of land and serve the homes and businesses located thereon. In the Sewee to Santee all of the septic tank systems generally consist of a septic tank and underground wastewater infiltration system (drain field). In several locations where the soils are inadequate, mound infiltration systems have been installed. In the state of South Carolina, approximately one-half of all homes are served by an OSDS (South Carolina Department of Health and Environmental Control, 1999).

1.2 Purpose and Objectives

The purpose of this study is to identify, collect, and synthesize information about various aspects of septic systems in the Sewee to Santee, excluding the Town of Awendaw, South Carolina. Similar projects have been conducted in the Town of McClellanville (Cofer-Shabica, 2005a) and in the communities of Huger and Wando, South Carolina (Cofer-Shabica, 2005b). Specific objectives of this project were:

Objective 1:

Household Septic Tank Surveys

- Conduct septic tank system and site surveys of up to 300 households.

Objective 2:

Water Surveys

- Collect water samples for bacteriological analysis from households surveyed in Objective 1.
- Collect samples under SC DHEC standards and have them analyzed by SC DHEC.
- Share the results of the analyses with the homeowner.

Objective 3:

Septic Tank Inspections and Pump-Outs

- Based on the results of the septic tank survey, select approximately 30 household septic systems for inspection and pump out.
- The results of the inspection to be shared with the homeowner.

Objective 4:

Soils Evaluations

- Conduct soil borings and evaluate soils at up to 40 households surveyed in Objective 1.

Objective 5:

Education Materials

- Distribute educational materials to all households surveyed in Objective 1.

Objective 6:

Management of Wastewater Systems and Community Meetings

- Introduce the community to the concept of the Onsite Wastewater Management System, as well as other means to manage onsite wastewater disposal systems.
- Enlist community support for establishment of such an entity.

CHAPTER 2

Septic Tank Surveys

2.1 Introduction

Wastewater treatment and disposal in the Sewee to Santee region is accomplished by septic systems or onsite disposal systems (OSDS) only. The nearest sewer lines are in the towns of Mt. Pleasant and Georgetown (Georgetown County – across the Santee River). Mt. Pleasant is served by the Mt. Pleasant Water Works (MPWW), whose area of legislated jurisdiction includes northeastern Charleston County and the Town of McClellanville. The comprehensive plan for the service area of the MPWW shows no future plans to bring water or sewer lines to the Town (Leo Russo, MPWW, *pers. comm*.).

The density of OSDS (Figure 2.1) varies significantly among the six coastal counties. Charleston County with 18.19 onsite systems per square mile has the third highest density of systems by coastal counties exceeded by Horry (18.86) and Beaufort (29.36) counties. Jasper County has only 6.51 onsite systems per square mile area.

To categorize the status of the septic systems in the Sewee to Santee a stratified selection of 300 of the 900+ households in the area was identified for interviews. The sample selection was stratified to ensure inclusion of all areas and soils types in the Sewee to Santee. To accomplish this, we used real property parcel lists provided by Charleston County, and selected every third parcel for sampling. If that residence was unoccupied (seasonal) or if no one was home, the property adjacent was selected. The survey instrument (Appendix A) required five iterations of development and testing, and was derived from survey instruments utilized by the South Carolina Department of Health and Environmental Control (Lisa Hajjar, *pers. comm*.), the Southeast Rural Community Assistance Project, Inc. (Bob Britts, *pers. comm*.), and the National Onsite Demonstration Program (Graham Knowles and Clement Solomon, *pers. comm*., NESC 2002).

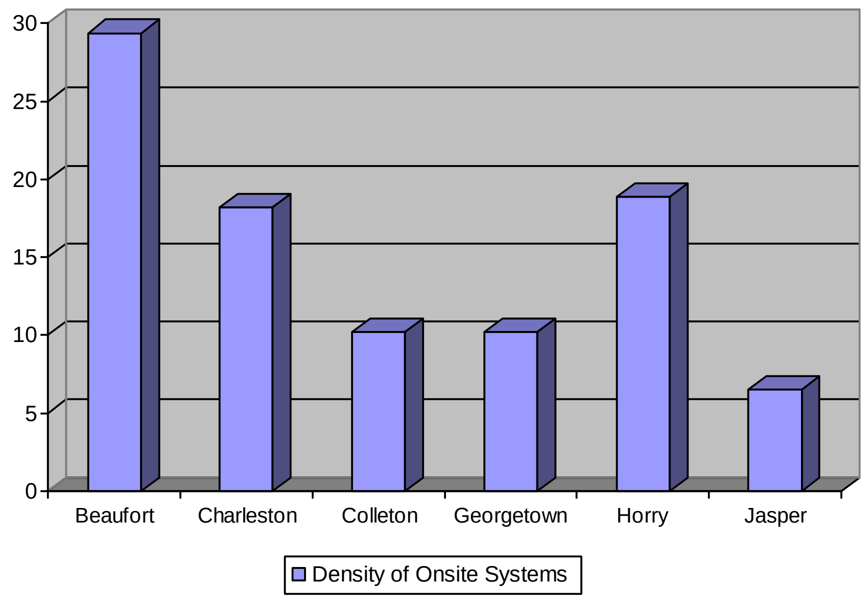


Figure 2.1 Density (#/sq mi) of onsite systems in Charleston County (NESC, 2002)

In addition to property identification questions, the survey focused on the number of occupants, utility connections to the septic system, gray water systems, age of the septic system, repairs, and frequency of pump-outs.

The surveys were conducted by Junior and Senior high school science majors from Lincoln High School in McClellanville. The idea for employing the students as surveyors came from the school Principal Juanita Middleton. She believed that the students would do an excellent job because they were highly motivated, honor roll students with a course emphasis on the sciences and math. It was also felt, that as the students would be surveying in their own neighborhoods, that this would essentially provide them with ownership in the project and in the outcome of the results for their community.

Intensive training of the students was conducted over several sessions that included lectures by staff members from SCDHEC (Steve Calk and Lisa Hajjar), consultant Clifton Roberts, and Stephen Cofer-Shabica. Students were teamed for role-playing so that before they went into the field, they had practiced delivering the survey, responding to questions, and asking questions for clarification.

2.2 Surveys

Students were paired-up and required to conduct each survey as a team; there was no individual survey work permitted. In the event one team member was unable to participate, an alternate trained student or parent was permitted to substitute. Lists by neighborhood were compiled and then every third household chosen from the list for the survey. Students were assigned lists of households from their neighborhoods. The students often contacted homeowners by telephone and made appointments to conduct the survey. Households with garbage disposal units were counseled on the potential harm that these pose to the function and longevity of septic systems.

Following each survey, prior to departing, homeowners were given the following informational brochures for their guidance and reference:

A Reference Guide, Your Septic System, for Homeowners. Southeast Rural Community Assistance Project, Inc. 145 W. Campbell Ave., Roanoke, VA 24001-2868. *www.sercap.org*

and

Water Lines, February 2004 issue, Mount Pleasant Waterworks, 1619 Rifle Range Rd, Mt. Pleasant, SC 29464. *www.mountpleasantwaterworks.com*

Your Septic System is an excellent, very readable overview of how septic systems function, their care and maintenance, and includes a comprehensive listing of "*Dos"* and "*Do Nots*." The emphasis of the February 2004 issue of *Water Lines* is on conservation and has information on "low-flow" fixtures, and how to check for leaks in household water systems, leaks – the silent killer of septic systems. To emphasize the concern about leaks, homeowners were given a "Flusher Flapper" replacement commode valve as a gift for their time, and shown how to determine if they had leaky commode valves (described in *Water Lines*).

2.3 Results

The data results are listed in Appendix B. The mean lot size was 2.86 acres. The smallest lot, that had a functioning septic system, was 0.15 acres. The mean house age was 39 years and ranged from less than one to 104 years. The mean number of household bedrooms and occupants was four and three, respectively. The mean age of all septic systems was 28 years with a range of less than one year to 51 years. The 51 year old system was still functioning with the recent replacement of its field lines. Fifty-seven percent of the septic tanks had never been pumped-out. Over 22 percent of households pump their septic tanks at least once per year suggesting some problems with the system: leaky utilities resulting in water overload, system overload, or failed drain field lines. Seventeen percent of households had water softeners, and only three percent had garbage disposals. It is interesting to note that 62% of households had the washing machine lines connected to their septic system. In the remaining 38%, the wash water typically flowed into the back or side yard or into a drainage ditch. This might account for the large number of septic tanks that never required pumping or that had few repairs.

<u>Chapter 3</u>

Potable Water Survey

3.1 Introduction

A majority of households rely on shallow wells less than 30 ft deep for their water. This water has a high iron content and often high particulate content (Cofer-Shabica and Wimbush, 2005). As a consequence, many homeowners travel to either Mt. Pleasant or Georgetown to purchase their drinking and cooking water in one and five gallon containers (Peter Smalls, *pers. Comm*.). For residents of Mt. Pleasant, the cost of one gallon of reverse osmosis treatment water, supplied by the Mount Pleasant Waterworks, is about one-quarter of one cent per gallon ($2.79 per thousand gallons – August 2005). The water purchased by homeowners from grocery or convenience stores in the Town costs between $0.75 and $1.25 per gallon (almost 400 times the cost of a gallon of water for residents of Mt. Pleasant) not including the cost of transportation to and from their homes.

To ascertain the bacteriological condition of the water in the area, a potable water survey of the households in the region was undertaken. Water samples were collected according to SCDHEC protocols by the student surveyors during the household Sanitary Situation survey (see Chapter 2). In this way, complete septic system information, including the location of the well relative to the septic tank and drain field, was matched with the water quality. Samples were taken to SCDHEC Environmental Quality Control in North Charleston and analyzed for bacterial contaminants: total coliform and fecal coliform bacteria.

3.2 Results

The analyses (Appendix B) of the household tap water showed that 33% (Figure 3.1) tested positive for total coliform Bacteria. Of these, six percent (Figure 3.2) had the more dangerous fecal coliform bacterial contamination. Residents whose water tested positive for fecal contamination were informed immediately of the contamination, either

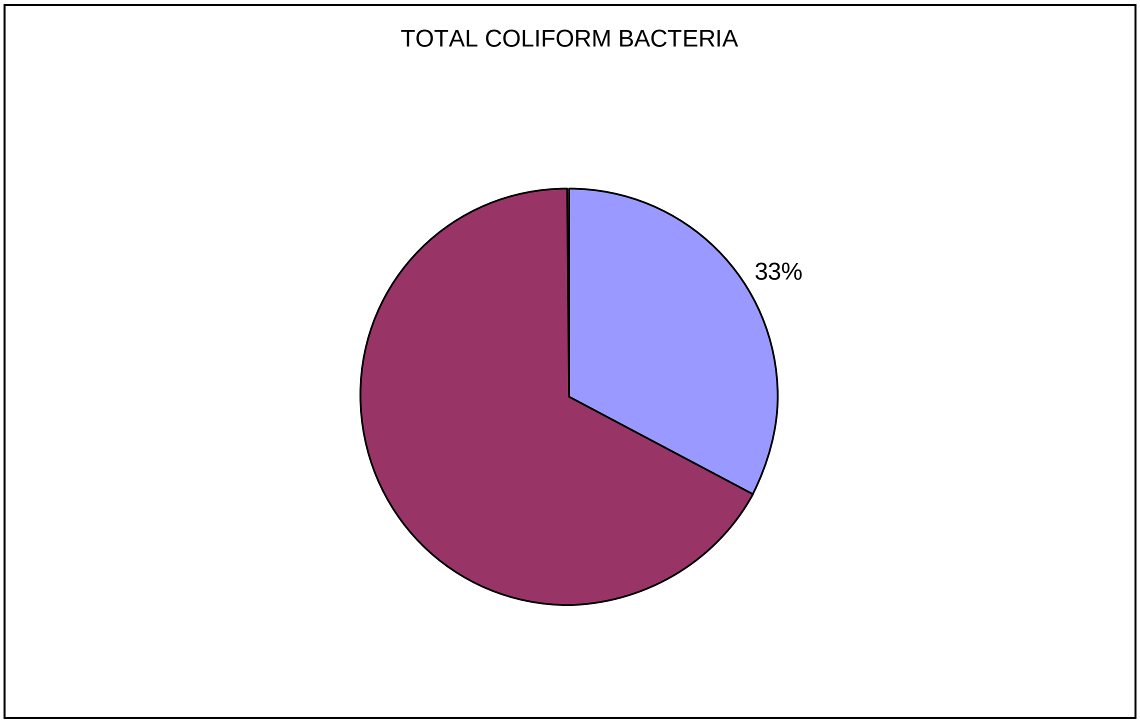


FIGURE 3.1

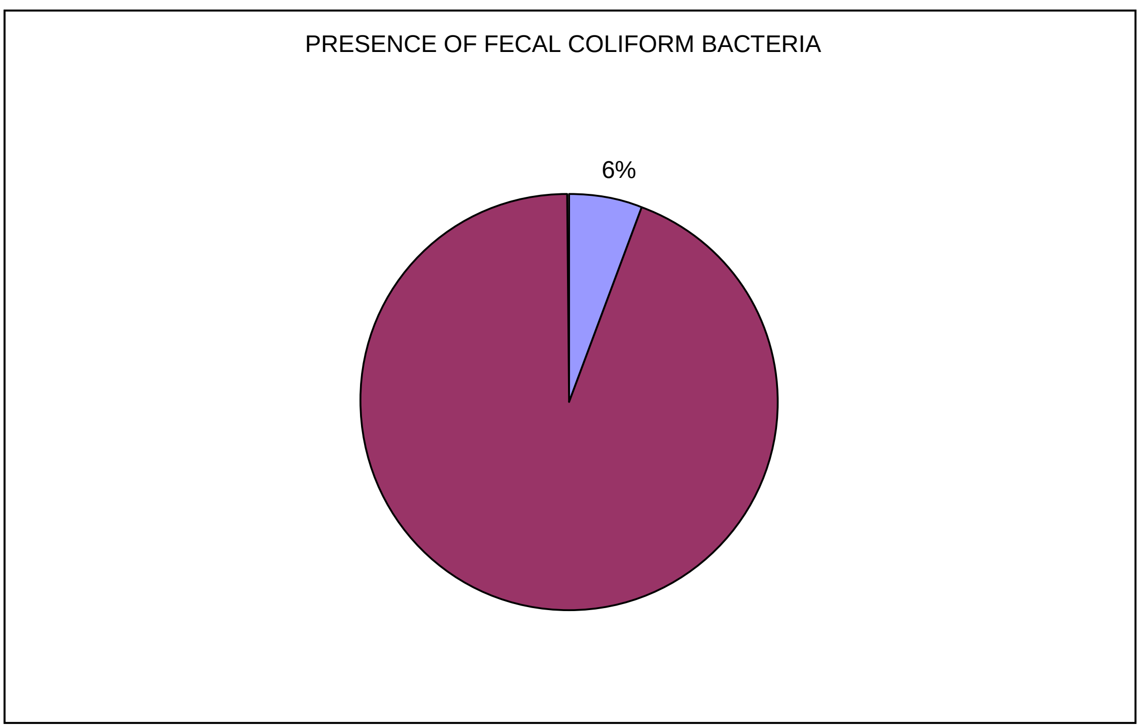


FIGURE 3.2

by phone or home visit, and given the SCDHEC instructions on the means to decontaminate their wells. Residents whose well tested positive for Total coliforms were informed by letter and instructed in decontamination procedures. All other households were notified by postal card that there well water was clear of bacteriological contamination. In several instances the Sewee to Santee CDC provided the gallon of bleach for the decontamination, and assisted in pouring the bleach into the well.

Few households (17%) in the Sewee to Santee rural region employ water softeners to reduce the mineral content (especially iron) and improve the aesthetic character of the water to prevent their white clothing from turning orange/rust colored after a month of washing (Cofer-Shabica, unpublished). In households where the hardness exceeds 200 mg/l (40.5% of those households surveyed) softening may produce a salty taste in the water (Cofer-Shabica and Wimbush, 2005). The effluent from water softening units is not harmful to septic systems or drain fields.

A number of solutions to the problem of contaminated water are possible. These range from the drilling of deeper, individual, private wells to the construction of community wells operated as a cooperative or utility, the installation of water softeners, or the installation of Point-of-Use Devices. Where it is necessary to treat small amounts of water for drinking and cooking, Point-of-Use Devices are a reasonable alternative and will treat up to 15 gallons of water per day for drinking and cooking. Point-of-Use Devices include Reverse Osmosis (RO) units, water distillation units better known as "stills," and bottled water. A properly operated and maintained RO unit is capable of removing up to 99% of dissolved minerals and metals from a water supply, but requires annual maintenance, as do water softeners.

Dear Homeowner, 28 October 2004

Your water sample, recently collected by students from Lincoln High School, was tested for the presence of a group of bacteria called **coliform bacteria** which are normally considered organisms that **may** indicate a water quality problem. The term **total coliform** is used to describe the entire group of these bacteria, including **fecal coliform** that are found in human and animal wastes. The **total coliform** test is the most commonly used test for determining the bacteriological quality of the water from your well.

<u>YOUR RESULTS</u>: **No coliform bacteria of any kind were found to be present in your water sample.** When **total coliform** bacteria are absent, no **fecal coliform** bacteria can be present and there is very little possibility of contracting a disease from the water. Your water should be safe to drink.

For additional information or assistance please feel free to contact us at the Sewee to Santee Community Development Corporation (887-4453) or DHEC's office of Environmental Quality Control (843-740-1590).

Figure 3.3 Post Card to inform residents of negative results

Chapter 4

Septic Tank Evaluations and Pump Out

4.1 Introduction

Based on the results of the Sanitary Situation Survey, 43 household septic systems were selected for inspection and pumping. There were a variety of different types of septic tank systems found during the survey. Most of the systems are conventional in nature with a standard septic tank and field lines placed in the natural soil. There are a few systems that incorporate pumps to move the effluent to a more desirable location for disposal. There are also a few systems that use fill material to overcome water table limitations on the site. The following criteria, in order of importance, were utilized in selecting systems for inspection:

A. System pumped once per year or more frequently
B. Frequent sewerage back-ups into home
C. Surfacing sewerage in yard
D. Never pumped

Each homeowner was asked to sign a liability release form prior to undertaking the system inspection. After the septic tank was located, it was uncovered sufficiently to allow visual access to determine the condition of the inlet and outlet Ts, and the thickness of the scum and sludge layers. The tank was then pumped, removing approximately 75-80 % of the sludge-scum-water slurry. The field lines were identified by probe, their extent measured, and then diagramed.

In general, how often a septic tank needs to be pumped depends upon the tank size and number of people, and habits of that particular household, among others. Garbage disposals and high water-use appliances also affect pumping frequency. Frequency can be estimated by using Table 4.1 recommended by the Pennsylvania State University Cooperative Extension Service (Robillard 1990).

Since the pumping frequency of a septic tank is highly variable, it was suggested to homeowners that conducting periodic inspections of the scum and sludge layers can help determine whether it should be pumped or not.

Table 4.1 Estimated septic tank pumping frequency in years

Tank size (gallons)	Household size (number of people) 1	2	3	4	5	6
500	5.8	2.6	1.5	1.0	0.7	0.4
750	9.1	4.2	2.6	1.8	1.3	1.0
900	11.0	5.2	3.3	2.3	1.7	1.3
1,000	12.4	5.9	3.7	2.6	2.0	1.5
1,250	15.6	7.5	4.8	3.4	2.6	2.0
1,500	18.9	9.1	5.9	4.2	3.3	2.6
1,750	22.1	10.7	6.9	5.0	3.9	3.1
2,000	25.1	12.4	8.0	5.9	4.5	3.7
2,250	28.6	14.0	9.1	6.7	5.2	4.2
2,500	31.6	15.6	10.2	7.5	5.9	4.8

4.2 Results

The septic tank system conditions evaluated, ranged from excellent to totally failed, and all permutations in between (Appendix B – Student Survey, Appendix C – Tank Evaluations). The average age of all systems was 28 years and the oldest in excess of 50 years. Twenty-one (7%) had been repaired during the previous fifteen years at an average cost of $810. Inspections and pump-outs were routinely carried out by 43% of homeowners with the time interval ranging from two to six years (Figure 4.1). Tank sizes ranged from 400 to 1000 gallon homemade and commercial, with most being 1000 gallon commercial tanks. Most tanks had functional inlet and outlet Ts, but several had none or the Ts were damaged. Several systems had lids that were cracked and/or had portions missing. These were often covered with pieces of plywood or tin. One of the excellent-rated systems that had never been pumped and was over 20 years old, had no scum layer and only six inches of sludge in a 1000 gallon tank.   The lid of one of the failed systems inspected (Figure 4.2) had collapsed into the tank and along with soils had filled the tank (originally approximately 400 gallon) to within 18 inches of the top. There was no inlet T, only a 4” drain pipe from the home, and the outlet T was under the soil and rubble allowing effluent to flow directly out of the tank into a well vegetated ditch. The cover for this system was a four by six foot piece of 3/8 inch plywood.

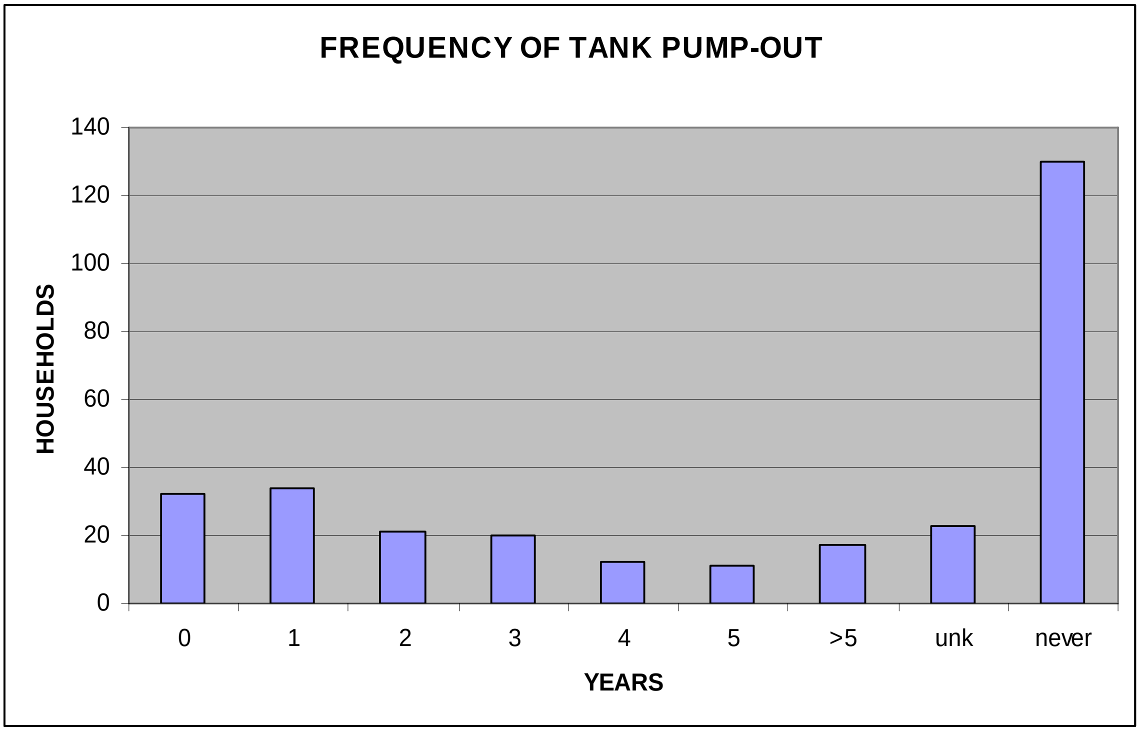
Eleven septic tank systems had conditions that would be considered “failing” (directly discharging sewage or effluent to the ground surface). To correct these problems, three of these systems need to be replaced completely. Several of the remaining systems should have all plumbing discharges (grey water lines) connected to their septic tanks and at least an additional 100 feet of field lines installed per site. These eleven systems are in need of immediate attention.

Thirteen of the systems inspected had signs of potential problems although these are not currently failing. Some of the common problems found were:

- Water level above outlet tee
- Too many solids in septic tank
- Tank too small

Most of these problems can be alleviated by increasing the pump-out frequency and/or adding additional field lines.

The failed systems that were inspected were far removed from waterways or freshwater or saltwater marshes in the area. At this time, it does not appear that septic systems are contributing in any measurable way to microbiological contamination of the waterways in the Sewee to Santee region. Although not affecting the waterways, these failed systems may serve as disease vectors for insects and wildlife. When taking into consideration the age of many of these systems, they appear to be better condition than we had anticipated. It is important to note that where repairs or upgrades are needed, the site conditions are favorable. The remaining systems in this survey appear to be working properly. Grey-water systems were found in 38% of households and included either the clothes washing machine and/or the kitchen and bathroom sink flows.



.Figure 4.1 Frequency of Tank Pumping in the CDC Region

Surface run-off will carry any microbial contaminants from domestic and wild life into the fresh and tidal waterways of the county. Surface run-off from impervious areas (roofs, roads, parking lots, and any paved areas) will carry similar contaminants under all but the lightest precipitation events. It is considered unusual for an individual septic system to contribute any contaminants to surface run-off during a storm event. The system may become temporarily flooded, but the effluent will be contained below ground and will disperse into the soil horizon as the flood levels drop. Several of the failed systems in the Sewee to Santee most likely contribute contaminants to surface run-off during storms, but as mentioned previously, these systems are far removed from water bodies allowing the effluent to disperse into the soil and be treated by surface plants and bacteria. Septic tank effluent entering the soil absorption system will contain three basic constituents, soluble and solid organic matter (BOD), plant nutrients, nitrogen and phosphorus, and potential pathogens, bacteria, and viruses. Much of the BOD will be removed by the biological activity in the bio-mat of the soil absorption trench, and the phosphorus will pass into the soil but will be adsorbed by the minerals in the soil particles. The nitrogen will be in the form of ammonia as it leaves the trench, but if the effluent passes through soil that is only partially saturated, nitrifying bacteria in the soil will oxidize the ammonia to nitrate. Flowing laterally once it reaches the influence of the water table, both ammonia and the nitrate may be selectively absorbed by plant roots. If below root level, the nitrogen will travel unchanged for considerable distances. Reaching the estuary or salt marsh, the effluent will pass through an organically rich area of sediments. If in the nitrate form, bacteria living in an oxygen-deprived state will use the oxygen of the nitrate for respiration, thus effectively de-nitrifying the plume. If the nitrogen is still in the form of ammonia, the plants of the salt marsh will remove much of the nitrogen (National Environmental Services Center, 2002).

Figure 4.2 Failed Septic System with 4 x 6 ft plywood cover

Chapter 5

Soils

5.1 Introduction

A total of forty-two sites were surveyed in the Sewee to Santee area for septic tank soil suitability. This survey consisted of performing at least one soil boring on each site and recording the soil profile. These profiles emphasize the soil textures and the **S**easonal **H**igh **W**ater **T**able (**SHWT**) indicators, as these are the major factors in determining suitability of a site for the placement of a septic tank system.

There are seven dominate soil classifications pertinent to the Sewee to Santee area and are described below (also see Table 5.1).

<u>The more dominant soils in the South Santee area are</u>:

Lakeland Sand
Chipley Fine Sandy Loam
Sewee Complex Soils
Rutledge Loamy Fine Sand

<u>The more dominant soils found in the Germantown area are</u>:

Lakeland Sand
Norfolk and Dotham Soils
Faceville Fine Sandy Loam
Hockley Loamy Fine Sand

Lakeland Sand: Moderately well-drained nearly level to sloping soils on coastal plain uplands. Typically, the surface layer is sand, about 7 inches thick. The upper 4 inches are grayish-brown and the lower 6 inches are brown. Light yellowish-brown sand extends to a depth of 40 inches and then very pale brown sand with a few mottles to 52 inches. Next to 80 inches or more deep is light gray and very pale brown sand with yellowish and reddish mottles. The SHWT is between 2.0 to 4.0 feet in natural conditions. These soils would be considered “moderate” to “good” for septic tank placement.

Chipley Fine Loamy Sand: Nearly level and gently sloping, moderately well-drained and somewhat poorly-drained soils on stream terraces and uplands in the coastal plain. In a representative profile, the surface layer is dark grayish brown loamy sand about 8 inches thick. The underlying layers to a depth of 80 inches are loamy sand. It is light yellowish brown and brownish yellow in the upper part and light gray in the lower part. They are rapidly permeable with a SHWT at 2.0 to 4.0 feet in natural conditions. Patulous soils formed in sediments from streams and the sea. These soils would be considered “moderate” to “good” for septic tank placement.

Norfolk and Dothan Soils: Typically, the surface layer is dark grayish-brown loamy sand about 7 inches thick. The subsurface layer from 7 to 17 inches is light yellowish-brown loamy sand. The subsoil from 17 to 58 inches is yellowish-brown sandy clay loam with gray, brown and red mottles below depths of 41 inches, and from 58 to 72 inches the subsoil is mottled gray, yellow, red and brown sandy clay loam. The SHWT is between 2.5 to 4.0 feet in natural conditions. These soils would be considered “moderate” to “good” for septic tank placement.

Faceville Fine Sandy Loam: Deep, moderately well-drained soils on the lower coastal plain. These soils have grayish fine sandy loam surface layers, about 13 inches thick and brownish to red clayey sub soils mottled with gray, which extend to 58 inches below the surface. The SHWT is between 3.0 to 4.5 feet in natural conditions. These soils would be considered “moderate” to “good” for septic tank placement.

Sewee Complex Soils: Sandy, somewhat poorly-drained, rapidly permeable soils on nearly level broad ridges and flats of the lower coastal plain. Typically these soils have a dark gray fine sand surface layer, a light yellowish-brown find sand subsurface layer over black and dark reddish- brown fine sand. The SHWT is from 1.0 to 2.5 feet during natural conditions. These soils would be considered “limited” to “moderate” for septic tank placement.

Hockley Loamy Fine Sand: Nearly level, moderately well-drained, moderately permeable soils on the lower coastal plains. In a representative profile, the surface layer is very dark grayish-brown loamy fine sand, 6 inches thick. The subsurface layer is yellowish-brown loamy fine sand, 7 inches thick. The subsoil extends to a depth of 62 inches. The upper 7 inches are brownish-yellow sandy clay loam. The next 36 inches are mottled yellowish-brown sandy clay loam. The lower 13 inches are mottled yellowish-brown sandy loam. The SHWT is between 1.5 to 3.5 feet in natural conditions. These soils would be considered “limited” to “moderate” to “good” for septic tank placement.

Rutledge Loamy Fine Sand: Deep, very poorly-drained soils on upland flats and in depressions. They were formed in coastal plain sediments. Typically, these soils have a black loamy sandy surface layer, 8 inches thick. A subsurface layer, from 8 to 18 inches, is very dark gray loamy sand. The substratum, from 18 to 60 inches, is mottled grayish-brown sand. These soils flood or pond and cannot be drained. The SHWT is within 6 inches from the surface, in natural conditions. These soils would be considered “severe” and not suitable for septic tank placement.

5.2 Results

For the entire suite of survey data, refer to Appendix D. A high proportion of the sites surveyed had soils with SHWTs between 18 and 24 inches from the surface and were sandy in texture.

Typical soil borings of the most common sites:

0-10”	Gray Brown	II	
10-20”	Pale Brown	I	
20-24”	Pale Brown	I	Red and Gray Brown Mottles
24-36”	Gray Brown	II	Red, Gray and Pale Brown Mottles

0-6”	Gray Brown	II	
6-14”	Pale Brown	II	
14-24”	Red Brown	III	
24-36”	Red Brown	III	Gray and Yellow Brown Mottles

The **most favorable** sites for septic tank systems had SHWTs greater than 30 inches from the surface and with a sandy textured soil.
Typical soil boring:

0-8”	Gray Brown	II	
8-36”	Yellow Brown	I	
36-40”	Yellow Brown	I	White and Pale Brown Mottles

The **least favorable** sites for septic tank systems had SHWTs less than 12 inches from the surface and were sandy textured.
Typical soil boring:

0-8”	Black	II	
8-16”	Dark Gray	II	
16-36”	Pale Brown	I	White, Gray and Red Mottles

Of the forty-two sites surveyed, twenty sites had soils considered “moderate” to “good” for septic tank use and support conventional or alternative septic tank systems. Eighteen sites were considered “limited.” These sites support conventional and alternative septic tank systems but require extensive site modifications such as landscaping and fill material. Four sites had soils considered “severe” for septic tank use and are considered unsuitable for conventional septic system placement and require innovative septic tank design.

SOIL TYPE	NUMBER OF SITES
Lakeland Sand	5
Chipley Fine Loamy Sand	13
Norfolk and Dothan Soils	2
Faceville Fine Sandy Loam	1
Sewee Complex Soils	9
Hockley Loamy Fine Sand	2
Rutledge Loamy Fine Sand	4
Other	6

Table 5.1. Soil Types in the Sewee to Santee

A number of the sites had soils with SHWTs between 18 and 24 inches from the surface and were sandy in texture. Although these sites are not considered ideal for septic tank systems, with proper planning and modern design techniques, these limitations can normally be overcome. The systems in these areas were functioning within expectations.

Chapter 6

Management of Wastewater Systems

6.1 Introduction and Findings

There are several important reasons for communities to consider implementing a community wastewater management system to manage septic systems:

- Protect public health and environment,
- Minimize “failure” (malfunction). Failure is any situation in which the public or environment is put at risk.
- Ensure compliance with county and state regulations.
- All septic systems or onsite disposal systems (OSDS) need maintenance, from the simplest to the most sophisticated,
- Many homeowners do not maintain systems: “*out of sight, out of mind”* or simply unbudgeted.

In 1997, the EPA issued a report titled *Response to Congress on Use of Decentralized Wastewater Treatment Systems,* that described the inherent benefits of properly managing onsite or decentralized wastewater systems:

- More cost-effective than central sewer alternatives, except in densely populated urban centers,
- Longer service lives for managed onsite systems vs. unmanaged systems,
- Faster response to problems and smaller problem impacts,
- Increased opportunity for better watershed management,
- Better groundwater protection and management capabilities, and
- Increased property values.

Despite the inherent advantages of properly managed septic systems, five major barriers continue to prevent the full utilization of community onsite or decentralized wastewater management systems:

- Lack of knowledge about the benefits and potential uses of onsite or decentralized systems on the part of regulatory officials, technical practitioners, local governments, and citizens,
- Legislative and regulatory constraints that discourage optimum use of onsite or decentralized systems,
- Lack of community OMSs that can optimize performance of OSDS technologies,
- Liability and engineering fees that discourage considering these alternatives, and
- Financial barriers that discourage the application of onsite or decentralized systems.

Overcoming these barriers requires significant effort on the part the local management organizations to support them. The EPA identified several actions, as essential in addressing the barriers, listed above:

Improved education of technical practitioners, including engineers, service providers (those responsible for site evaluation, installation, and operation/maintenance), regulators, local citizens, and political leaders who need to understand how systems work, how they should be managed, and how they affect public health and water quality. Efforts by the U.S. Department of Agriculture (USDA) and other national organizations are underway to improve education of engineers, service providers, regulators, and others who assist small communities.

Improved regulatory programs based upon system performance, rather than using restrictive codes that rely on assumptions that certain site characteristics will protect public health and water resources. The EPA, the National Onsite Wastewater Recycling Association and some states are seeking to develop management approaches to expand the range of technical options to solve existing onsite wastewater problems.

Establishing supportive financing programs that assist local communities in creating and implementing effective management programs. The EPA, USDA, and others have programs designed to assist small communities. Federal, state, tribal, and local governments, as well as private sector funding sources and public/private partnerships, need more creative financing approaches.

A community wastewater management system includes an organizational structure, planning activities, responsibilities, practices, procedures, processes, and the resources for developing, implementing, achieving, reviewing, and maintaining the community's onsite or decentralized wastewater management policy. A community's onsite or decentralized wastewater management policy is the community's statement of its intentions and principles in relation to its overall onsite or decentralized wastewater management performance that provides a framework for action and for setting its onsite or decentralized wastewater management objectives and targets. Such a policy is appropriately formulated to meet a community's needs, and includes a commitment to comply with existing regulations and prevent pollution as well as a commitment to continually improve. Planning, implementation, operation, checking and corrective action along with management reviews, are integral elements of an effective community management system.

Elements of an effective community onsite or decentralized management system as outlined by the EPA are listed below. The activities associated with each *element* are based upon local resources and capabilities but should address the public health and environmental goals of the community. Communities should find the appropriate mix of elements and activities to meet their health and environmental goals. The enabling of a wastewater management system should be a community decision that the system is appropriate, affordable, and sustainable over time.

Planning based on cumulative impacts upon human health and water resources,
Performance requirements to ensure appropriate system design and technology selection,
Site evaluations and wastewater characterizations to guide system sizing and design,
System designs that consider site conditions and performance requirements,

Construction oversight to ensure compliance with design, siting, and performance criteria,

Operation and maintenance functions focusing on performance and minimize risk,

Residuals management programs that protect health and water resources,

Training, Certification and licensing of regulators and all service providers,

Public education and involvement programs for the serviced population,

Inspections and monitoring to assess and document performance and initiate remediation,

Checking & Corrective actions to ensure compliance when systems require repair, expansion, or replacement,

Record keeping and reporting to support planning and management activities, and

Financial assistance to support management programs and system installation/repair.

An introduction to the concept of a Wastewater Utility as well as other means to manage wastewater disposal systems (see **Table 6.1**) was provided to the community during the Community Visioning meeting. At that time an effort was made to enlist community support for the establishment of such an entity. As part of the Sanitary Situation Survey, homeowners were provided with a generic description of a wastewater management system, asked if they would participate in such an entity, and if so, would they be willing to pay a monthly fee for such a service? In the Sewee to Santee 69.3% of homeowners favored the formation of a wastewater management cooperative or utility and were willing to pay an average of five dollars per month for the service (this ranged from an inability to pay to a monthly payment of $20).

In addition to the Community Visioning meeting, three public meetings were conducted during the project to ensure full public participation in the project's direction and decision making.

Table 6.1 Summary of approaches for managing onsite or decentralized wastewater treatment systems (from National Environmental Services Center. 2002).

Approach	(1)Objectives	(2)Typical Application	Benefits	Limitations
1	**INVENTORY AND MAINTENANCE REMINDERS** Appropriate for areas of low environmental sensitivity where sites are suitable for conventional onsite systems, which are effective in protecting public health and water quality.	Ensures systems are sited and constructed properly in accordance with state/tribal/local codes and regulations that prescribe siting and design criteria that are deemed to satisfy performance requirements. Seeks to ensure that systems are regularly maintained and repaired as necessary by striving to make owners aware of maintenance needs through reminders sent to the owners by the regulatory authority. Establishes a database inventory of all systems (locations, designs, permits, and inspection reports) within the jurisdiction.	Ensures code compliant system is sited, designed and installed. Relatively easy and inexpensive to implement and maintain because it is based on existing, prescriptive system designs that rely on restrictive site criteria and system design requirements promulgated in existing codes. Provides an inventory of systems that is useful in system tracking and area-wide planning.	No mechanism provided to confirm operating compliance of systems. No mechanism provided to identify problems before failures occur. Limits building sites to those meeting the prescriptive siting requirements. Requires regulatory authority investment to implement a database of permitted systems and an owner education program.
2	(a)MAINTENANCE CONTRACTS Appropriate for areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems either due to small lots, shallow soils, or low permeability soils.	Ensures systems are sited and constructed properly in accordance with state/tribal/local codes and regulations that prescribe siting and design criteria that are deemed to satisfy performance requirements. Allows the use of more complex treatment options that may include mechanical components. Requires service contracts be maintained over the life of the system between the system owner and the equipment manufacturer, supplier, or independent service provider. Establishes a database inventory of all systems (locations, designs, permits, and inspection reports) within the jurisdiction. Establishes a service contract tracking system.	Reduces the risk of treatment system malfunctions through the requirement for sustained routine maintenance of mechanical components by skilled personnel.	State/tribal/local regulatory authority may have difficulty in tracking and enforcing compliance because it must rely on the owner or contractor to report a lapse in a valid contract for services. No mechanism is provided to assess the effectiveness of the maintenance program.

Approach	(3)Objectives	(4)Typical Application	Benefits	Limitations
3	(b)OPERATING PERMITS Appropriate for areas of greater environmental sensitivity such as wellhead or source water protection zones, shellfish growing waters, bathing or water-contact recreation or other areas where prescriptive designs alone are inadequate for meeting public health and water quality requirements.	Establishes system performance requirements for receiving environments including maintenance monitoring, possibly water quality monitoring, and compliance monitoring reporting. Allows engineered designs but also provides prescriptive designs for specific receiving environments. Allows regulatory oversight of system performance throughout its service life by issuing operating permits that must be renewed periodically but may be revoked for non-compliance. Establishes a database inventory of all systems (locations, designs, permits, and inspection reports) within the jurisdiction. Establishes a system inventory database and operating permit and compliance monitoring report tracking systems.	Allows use of onsite treatment systems in more environmentally sensitive areas or for wastes that may pose more of an environmental risk. Reduces the risk of a system operating out of compliance through a renewable/revocable operating permit issued to the owner that requires regular compliance monitoring reports. Routinely identifies non-compliant systems and initiates corrective actions.	Needs a higher level of technical/engineering expertise on part of regulatory authority to implement. Requires an effective permit tracking system. Education and enforcement activities of the regulatory authority will increase. Requires that the regulatory authority have the powers to issue citations and assess fines and penalties.
4	(c)RME* OPERATION AND MAINTENANCE Areas of moderate to high environmental sensitivity where sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, outstanding value resource waters, or other critical resources exist where environmental and/or treatment complexity concerns require reliable and sustainable system operation and maintenance for resource protection or restoration.	Establishes system performance requirements for receiving environments including maintenance monitoring, possibly water quality monitoring, and compliance monitoring reporting Provides professional operation and maintenance services through RME (either public or private). Provides regulatory oversight by issuing operating or NPDES permits directly to the RME (system ownership remains with the property owner). May require the RME to monitor parts of the watershed. Establishes a database inventory of all systems (locations, designs, permits, and inspection reports) within the jurisdiction. Establishes a system inventory database and operating permit and compliance monitoring report tracking systems.	Responsibility for operation and maintenance is transferred from the system owner to a professional RME that is the holder of the operating permit. Routine monitoring and inspections identify problems needing preventive maintenance before failures occur. Allows use of onsite treatment systems in more environmentally sensitive areas or for wastes that may pose more of an environmental risk. Number of permits requiring tracking by the regulatory authority are reduced by issuing one permit for a group of systems in a watershed.	Enabling legislation may be necessary to allow a RME to hold the operating permit for an individual system owner. The RME must have owner approval to repair or replace system components, which may create conflicts between system owner and RME if performance problems identified and not corrected. Property owner may not agree to grant an easement for system access by the RME. Oversight by the regulatory authority is needed to ensure that the RME has the technical and financial capability to provide reliable and sustainable operation services to meet the permit requirements

Approach	(3)Objectives	(4)Typical Application	Benefits	Limitations
5	(d)RME OWNERSHIP Areas of greatest environmental sensitivity as described in Management Program 4. Preferred management program for cluster systems serving multiple properties under different ownership.	Establishes system performance requirements for receiving environments including maintenance monitoring, possibly water quality monitoring, and compliance monitoring reporting. Provides professional management of the planning, siting, design, installation, operation, maintenance, regulatory compliance, watershed monitoring, customer service, financing, and administration of decentralized systems through the public or private RMEs that own and manage individual systems. Provides regulatory oversight by issuing operating or NPDES permits that may require watershed monitoring directly to the RME. Establishes a database inventory of all systems (locations, designs, permits, and inspection reports) within the jurisdiction. Establishes a system inventory database and operating permit and compliance monitoring report tracking systems.	Achieves a high level of oversight for existing systems that may have performance problems. Simulates the municipal model of central sewerage by transferring all responsibilities from the system user to a RME, reducing the risk of non-compliance to the lowest level. Allows use of onsite treatment systems in more environmentally sensitive areas or for wastes that may pose more of an environmental risk. Allows effective area-wide wastewater planning and watershed management through the integration of decentralized systems with conventional sewerage under a single RME. Avoids the potential for conflicts between the user and RME that exists in Management Program 4.	Acquiring private property easements or land for treatment sites necessary for the RME to perform its functions may require formation of a public special purpose district. Greater financial investment may be necessary by the RME for installation and/or purchase of existing systems or components. Oversight by the regulatory authority is needed to ensure that the RME has the technical and financial capability to provide reliable and sustainable services to meet the permit requirements.

* - RME (Responsible Management Entity)

As noted previously, local programs will vary depending on the unique regulatory, ecological, and economic conditions of each community.

Chapter 7

Summary and Conclusion

7.1 Summary

The mean lot size in the survey of 303 households was 2.86 acres, with the smallest lot, having a functional septic system, being 0.15 acres. Home ages ranged from less than one to 104 years with the mean age of all septic systems 28 years (range: 1 – 51). The mean number of bedrooms and occupants was four and three, respectively. Fifty-seven percent of the septic tanks had never been inspected nor pumped. Over 22 percent of households pump their septic tanks at least once per year suggesting some problems with the system: leaky utilities resulting in water overload, system overload, or failed field lines. Seventeen percent of households had water softeners, and only three percent had garbage disposals. Thirty-eight percent of households had the washing machine drain and at least one sink drain line piped into the back or side yard or into a drainage ditch. This perhaps accounts for the large number of septic tanks that never required pumping or that had few repairs.

Twenty-one (7%) septic systems had been repaired during the previous fifteen years at an average cost of $810. Inspections and pump-outs were routinely carried out by 43% of homeowners with the time interval ranging from one to six years. The average pump-out cost was $131 but ranged up to $250. One septic system pumper routinely charges $100 to $125 in the Sewee to Santee. Tank sizes ranged from 400 to 1000 gallon homemade and commercial, with most being 1000 gallon commercial tanks. Most tanks had functional inlet and outlet Ts, but several had none or the Ts were damaged. Several systems had lids that were cracked and/or had portions missing. Grey-water systems were found in 38% of households and included either the clothes washing machine and/or the kitchen sink and bathroom sink and tub flows.

Results from the survey shows that many homeowners understand the operation and care of their septic system. There are systems that need to be replaced, upgraded, or repaired. There is an urgent need to improve the potable water supply in the region by the installation of Point-of-Use Devices, the drilling of deeper individual, private wells, or the construction of community wells operated as a utility.

Soils were evaluated at forty-two sites throughout the Sewee to Santee. Twenty of the home-sites had soils that were “moderate” to “good” for septic tank use and support conventional or an alternative septic tank systems. Eighteen sites were “limited,” and would likely support an alternative septic tank system but would require extensive site modifications such as landscaping and fill material. Four home-sites had soils considered “severe” for septic tank use and would be considered unsuitable for septic tank placement or would require an innovative/experimental septic tank design.

The well water sampled from 33% of the homes surveyed was contaminated with coliform bacteria and six of those wells were contaminated with health threatening fecal coliform bacteria.

Members of the Sewee to Santee community (almost 70%) favor the formation of a wastewater management entity (Onsite Management System), and are willing to contribute financially.

In the Sewee to Santee region there is a critical need to improve the potable water supply by the construction of community wells operated as a cooperative or utility, the drilling of deeper individual wells, the installation of Point-of-Use Devices or water softening systems, or some combination of these four.

7.2 Conclusion

A commitment from local leaders is essential in moving the Sewee to Santee forward, building on its initial commitment, to enable an Onsite Management System (OMS). The CDC performed a Community Self Assessment (Graham Knowles, 2002a) that fostered an awareness and provided the factual basis for wastewater management decisions, and has set the stage for the development of an acceptable wastewater management policy. Such a policy will be based on the assessment findings along with recommendations made by the community members and professional groups, and the input, cooperation and resources of the Mount Pleasant Waterworks and the Charleston County Planning Department to ensure effective implementation of the wastewater management policy.

7.3 Community Vision for the Sewee to Santee

On Saturday, June 25th, twenty-seven members of the Sewee to Santee community worked through a series of exercises (Graham Knowles, 2002b) starting at 8:30 am, and by late afternoon had crafted the following statement for their community.

Vision Statement
25 June 2005

The unincorporated area of the Sewee to Santee region of South Carolina includes the land from Sewee Road to the South Santee River. The residents of the Sewee to Santee value maintaining the rural character and cultural diversity of our neighborhoods and communities. Important characteristics of this region include good water and air quality, open spaces, and the individual nature of the Sewee to Santee.

To preserve and maintain our existing land-use and to encourage low-impact development, we support the maintenance and management of individual onsite wastewater treatment systems. We reject centralized wastewater treatment systems that would encourage land development and population growth. We support a clean environment that will benefit the entire Sewee to Santee area. We support community knowledge of safe drinking water, and locally controlled onsite management and maintenance through educational and awareness programs that are shared by the entire community. We recognize the diverse economic nature of our residents and encourage a maintenance system that will not be a financial burden to anyone.

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Appendix A

Sanitary Situation Survey Form

1. Community ____

2. Address ____

3. Property Owner__________________________ Phone #____________________

4. Plat Map Identifier ______________ Acreage _____ Age of Home ______years

5. How Long Have You Lived Here? _______years

6. How many bedrooms are in your home? _______ How many live in your home?_____

7. Does your home have any of the following:

   ☐washing machine ☐garbage disposal ☐hot tub or spa ☐in-ground lawn sprinkler

8. Is your washing machine connected to the septic system? ☐Yes ☐No

   If "No" where does it drain? ____

9. Is your hot tub or spa connected to the septic system? ☐Yes ☐No

   If "No" where does it drain? ____

10. Do you know approximately where your septic system is located? ☐Yes ☐No

11. Is there parking or driving over any part of your septic system? ☐Yes ☐No

12. Where does your drinking water come from? ☐Private well ☐Shared well

    ☐Other____________________________________

13. About how old is your septic system? ☐0-5 years ☐6-10 years

    ☐11-20 years ☐More than 20 years ☐Don't know

14. Have you ever had your septic system repaired? ☐Yes ☐No ☐Don't know

    If "Yes" what was done? ____

    ___________________ How much did it cost? ______________

15. Have you noticed any of the following conditions related to your septic system:

    ☐Wetness in yard (unrelated to rain) ☐Septic discharge ☐Strong sewerage smell in yard

    ☐Slow drainage of your plumbing ☐Sewage back-ups into home

    ☐Well water test shows positive for Fecal Coliform bacteria

16. When was the last time that your septic tank was pumped________, and how much did it cost_________? How often do you have it pumped? ________________

17. Do you have a water softener? ☐Yes ☐No

18. Would you support the formation of a wastewater utility that would care for the maintenance, repair, and even replacement of your septic system? ☐Yes ☐No

If "Yes", how much money would you be willing to pay, per month for this service?

☐$0 ☐$5 ☐$10 ☐$15 ☐$20

19. Map: Show with approximate distances (in feet): buildings, driveways, roads, **wells, septic tank, drainfield, ditches**, and ponds, etc.

KEY

NORTH

Building : ☐
Drainfield : -----DF------
Septic tank : ST
Well : W

____
30 feet

How far away is the closest drainage ditch (as the crow flies)? ☐Less than 100 ft ☐A few hundred yds ☐Half mile or more

Are there areas or lines of greener, taller grass in the yard? ☐No ☐Yes (show on map: **GGR**)

Are there any wet or spongy places in the yard that have a sewage odor? ☐No ☐Yes (show on map: **SP**)

______________________ Signature of Surveyor 1

______________________ Signature of Surveyor 2

______________________ Signature of Property Owner

______________________ Date

Appendix B

Sanitary Situation Survey Results

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	1.397	50	40	4	3	0	0	40	0		never		0	1	1		
	7.926	32	32	3	3	0	0	32	0		never		0	0	1		
	1.510	30	30	4	2	1	0	30	0		never		0	20			
	0.984	4	4	4	1	1	0	4	0		2000	150	0	1			
	1.756	18	15	4	3	0	0	18	0		never		1	15			
	1.110	25	25	4	2	1	0	25	0		1984	100	0	20			
	7.329	4	4	3	3	1	0	4	0		never		0	15			
	0.998	10	10	3	5	1	0	10	0		2000	100	0	20	1		
	2.016	68	68	4	1	0	1	40	0		never		0	1			
	0.481	79	79	3	1	1	1	40	0		never		0	0	1		
	0.727	15	15	3	1	1	0	15	0		2000	95	0	10	1		
	2.601	22	22	5	4	0	0	22	1	1500	2002	100	1	0			tank last pumped 2002
	1.187	10	9	5	8	1	0	10	0		2000	110	0	15			
	2.512	10	8	4	2	1	0	10	0		never		0	1			
	2.595	10	10	3	2	1	0	10	0		never		0	1			
	1.266	20	20	3	2	1	0	20	0		2000	125	0	10			
	0.840	35	10	3	3	1	0	9	0		2002	125	0	1	1		
	0.773	48	48	5	4	0	0	20	1	1800	1999	110	0	20			wash water to sep. tank, rep. field
	3.661	6	6	3	5	1	0	6	0		never		0	0	1		
	6.574	3	3	4	4	1	0	3	0		never		0	10	1		
	1.072	30	12	4	3	1	0	30	0		1984	100	0	5			
	48.878	34	22	4	2	0	0	20	0		2003	100	0	1			septic discharge, slow drains
	0.522	45	45	8	2	0	0	40	0		never		0	0			pumped out once, long time ago
	5.140	30	30	6	2	0	0	30	0		2000	800	0	0	1		pumped out, repairs
	0.914	26	20	5	4	0	0	26	0		unk	75	0	1	1		slow drainage of plumbing
	0.809	20	1	3	2	1	0	20	0		never		0	0			
	1.761	20	20	7	1	0	0	20	0		2001	135	0	10			pump every 4 years
	1.124	34	34	3	1	0	0	34	0		2003	175	0	20	1		pump every 3 yrs, grey-water
	0.605	30	28	3	1	0	0	28	0		unk		0	0	1		
	0.568	12	12	4	2	1	0	12	1		unk		1	0			
	0.425	4	4	5	4	1	1	4	0		never		1	0			hot tub, in-ground sprinkler
	0.695	90	40	4	3	1	0	20	0		2003	300	0	1			
	0.683	14	14	3	2	0	0	14	0		unk		0	5	1		
	0.735	33	33	4	6	0	0	33	0		never		0	5			
	1.089	80	10	5	18	0	0	20	0		never		0	1		1	wash water drains to backyard
	1.178	34	13	4	5	1	0	20	0		unk		0	5	1		

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	0.997	20	20	4	5	1	0	20	0		unk		0	0	1	1	hot tub, drains to yard
	0.819	20	20	3	2	1	0	20	1		1999		0	1			drain rep., pumped twice since 84
	0.894	10	10	3	3	1	0	10	0		2003	100	0	0			not often pumped
	0.762	7	7	4	2	0	0	7	0		never		0	0			wash water drains to backyard
	1.502	20	20	4	2	0	0	20	0		never		0	1			wash water drains to backyard
	4.990	8	8	4	5	1	0	8	0		2003	500	0	20	1		pumped four times in the last yr
	0.913	19	19	2	2	1	0	10	0		2003	110	0	0	1		pumped when needed
	3.000	76	76	3	5	1	0	10	0		2003	189	1	5			pumed every 1 - 2 years
	4.401	6	6	3	1	0	0	6	0		yes	free	0	1	1		wash water drains to back woods
	0.945	14	14	3	2	0	0	14	0		never		0	0			
	1.262	11	5	6	4	1	0	11	0		never		1	20	1		
	0.781	8	8	5	8	0	0	8	0		2004	500	1	20			pumped once a year
	5.336	45	17	2	1	1	0	40	0		2003	120	0	0			pumped every ten years
	0.884	1	1	2	1	0	0	1	0		unk		0	0			
	0.739	26	26	3	3	0	0	26	0		unk		0	1			hot tub, pumped when needed
	2.483	6	6	2	4	0	0	6	0		2004	125	0	0			pumped every five years
	1.054	14	14	3	2	1	0	14	0		1990	100	0	1			
	0.973	23	23	4	1	1	0	23	0		never		1	0			
	1.919	30	30	3	2	0	0	20	0		2004	200	0	5			pumped every two years
	0.916	60	50	3	2	0	0	50	0		2003	125	0	5	1		pumped when needed
	1.054	24	24	4	2	1	0	24	0		2004	195	0	1	1		pumped every one to two years
	1.024	62	8	4	1	1	0	40	0		2001	200	0	0			
	2.911	15	10	3	3	1	0	15	0		never		0	1			
	1.922	20	20	10	16	1	0	20	0		2004	185	0	20	1		pumped every six months
	0.698	28	3	3	4	1	0	7	0		never		0	5			
	1.048	51	51	4	5	0	0	51	0		2003	100	1	15	1		pumped every 3 to 4 years
	0.533	3	3	3	5	1	0	3	0		never		0	5	1		
	1.790	4	4	3	1	1	0	4	0		never		1	0	1		
	1.495	10	10	4	3	1	0	10	0		2004	100	0	15			
	1.079	34	24	3	2	0	0	20	0		1999	unk	1	0			wash water drains to field line
	1.022	15	15	3	2	1	0	15	0		2001	100	0	5			
	18.127	48	11	4	4	1	0	46	0	1000	2002	100	0	5			new drain field
	6.118	68	15	3	5	1	0	40	0		never		1	0			
	17.577	21	21	3	1	1	0	21	0		never		0	0	1		
	17.154	15	4	3	2	1	0	15	0		unk		0	0	1		
	4.429	13	13	3	3	1	0	13	0		never		0	0	1		

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	4.048	68	10	4	2	0	0	40	0		never		1	15	1		wash water drains to ditch
	9.462	20	5	2	3	1	0	20	0		2003	100	0	5			pumped as needed
	9.462	5	5	3	2	1	0	5	0		2003	100	1	10			pumped as needed
	15.239	25	19	4	5	0	0	25	0		1989	unk	1	10			pumped due to Hugo
	0.596	31	6	2	2	0	0	31	0		2003	200	0	5	1		pumped once a year
	0.966	22	19	3	3	1	0	10	0		2002	200	0	0	1		pumped every four years
	4.979	5	1	3	3	1	0	5	0		never		1	20			
	2.043	13	3	4	5	1	0	13	0		never		1	10	1		
	9.893	10	8	3	2	1	0	10	0		2000	unk	1	20	1		pumped every four years
	0.507	38	38	3	2	0	0	10	0		never		0	0			system replaced 1994
	0.992	50	2	2	3	1	0	40	0		never		0	20	1		
	31.886	53	15	2	3	1	0	10	0		2001	100	1	15			system replaced 1994
	2.032	74	50	3	4	0	0	40	0		2002	125	1	0	1		pumped every two years
	3.270	55	41	4	2	1	0	41	0		never		0	0	1		
	2.501	49	47	3	2	1	0	47	0		1994	unk	1	0			
	1.011	40	40	5	2	0	0	40	1	1000	1994	315	1	15	1		wash water to yard, new field 94
	4.702	50	50	4	1	0	0	40	0		1998	unk	0	10			pumped every five years
	2.219	50	50	3	2	1	0	40	0		2004	110	0	20			pumped every two years
	0.768	10	3	3	3	0	0	10	0		never		0	0	1		
	1.052	64	1	3	1	0	0	40	0		unk		0	0			wash water drains to yard
	0.525	29	29	3	2	0	0	29	0		unk		0	0			destroyed survey sheet
	0.608	34	34	3	2	1	0	10	1		never		0	1	1		system replaced 1996
	0.535	34	34	5	4	0	0	34	0		2000	120	0	10			wash water drains to ditch
	4.037	20	20	4	3	1	1	20	0		2001	175	0	10			hot tub, pumped as needed
	2.542	28	26	2	1	0	0	26	0		unk		0				refused interview
	4.923	9	3	3	2	1	0	9	0		never		0	0	1		
	2.328	30	5	2	3	1	0	40	0		2003	150	1	0			
	1.220	15	15	5	4	1	0	15	0		2002	150	0	15			pumped once a year
	1.259	1	1	4	2	1	0	1	0		never		0	20	1		
	1.235	54	54	3	2	1	0	10	0		never		0	5			system replaced 1994
	1.134	15	15	3	4	1	0	15	0		2001	125	0	15	1		first time pumped
	0.997	15	15	3	4	1	0	15	0		unk	85	0	1			
	0.690	15	15	3	3	1	0	15	0		1999	80	0	0	1		
	1.008	14	14	3	2	1	0	14	0		never		0	1			
	1.001	10	10	3	3	1	0	10	0		2003	150	0	0			first time pumped
	1.065	43	43	4	6	1	0	10	0		never		0	10			system replaced 1994

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	1.116	7	7	4	2	1	0	7	0		2001	100	0	0			pumped every three years
	0.723	15	15	3	3	1	0	15	0		1997	unk	0	1			
	0.953	7	7	4	2	1	0	7	0		2003	100	0	20			first time pumped
	1.975	3	3	3	3	1	0	3	0		never		0	1			
	2.000	8	8	4	2	0	0	8	0		never		0	10			
	5.107	50	50	5	2	0	0	40	0		1994	80	0	10			
	1.559	50	20	5	2	1	1	10	1	800	1998	unk	0	0	1		
	2.166	5	5	4	1	1	0	5	0		2004	unk	0	10			wash and spa water to septic
	2.863	53	53	3	1	0	0	10	0		2002	180	0	0	1		
	2.005	18	18	3	3	1	1	18	0		never		1	20	1		wetness in yard
	2.942	45	38	3	3	0	0	38	0		2002	90	0	15			
	2.110	30	30	3	2	1	0	10	1		never		0	1			system replaced 1994
	8.260	2	2	3	3	1	0	2	0		never		1	0			
	2.008	53	53	1	1	1	0	5	0		2003		0	5	1		shared well
	2.370	2	2	3	3	1	0	5	0		never		1	5			
	1.006	41	41	5	3	0	0	41	0		2003	unk	0	0			pumped once a year
	1.850	52	18	3	1	0	0	40	1		2001	unk	1	0	1		wash water to ditch, rep. 2001
	1.632	4	3	3	2	0	0	4	0		never		0	0	1		
	0.780	6	3	1	1	1	0	6	0		2001	unk	1	0			no water sample
	0.616	64	64	3	1	0	0	40	0		1994	unk	0	0			wash water drains to back yard
	0.686	32	23	3	1	1	0	23	0		1999	200	0	10	1		routine pump out
	0.768	4	4	3	2	1	0	4	0		2004	100	0	10	1		routine pump out
	0.502	33	10	2	4	0	0	20	0		2004	100	0	5	1		
	0.389	51	51	4	2	1	0	2	1		never		1	20	1		entire system repaired 2002
	5.729	35	35	3	2	1	0	35	0		never		1	5			
	0.554	64	64	4	1	0	0	40	0		never		0	5			
	0.607	65	65	3	1	1	0	20	0		2003	100	0	5			
	1.952	35	35	4	5	1	0	35	0		2002	150	0	5			
	1.019	25	25	5	2	0	0	25	0		never		0	20	1		
	0.715	35	33	4	2	1	0	33	0		2004	100	0	1			pumped every three to four yrs
	1.700	77	2	2	2	1	0	40	1		never		0	0			roots in lines
	2.836	6	6	3	3	1	0	6	0		2004	120	0	0	1		
	0.562	42	32	3	2	0	1	32	0		2001	99	1	0	1		wash water drains to ditch
	2.285	64	64	3	1	0	0	40	0		2002	100	0	1			no washing machine
	0.965	52	28	4	3	0	0	28	0		1999	100	0	10	1		wash water drains to ditch
	1.394	21	7	3	4	1	0	20	0		never		0	20			

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	0.769	25	25	3	2	0	0	25	0		never		0	20			wash water drains to ditch
	0.688	34	34	3	2	1	0	34	1	100	2000	75	1	10			pumped every 3 to 4 years
	3.590	3	3	3	2	0	0	3	0		never		0	0			
	0.719	22	22	5	3	1	0	22	0		never		0	5			hot tub connected to septic
	1.976	3	3	3	2	1	0	3	0		2002	225	0	10			pumped every three to four yrs
	1.124	5	5	4	2	1	0	5	0		never		0	10	1		
	1.485	25	24	3	1	1	0	20	1		1994	200	0	15			new system 1990
	0.756	30	30	4	4	0	0	30	0		never		0	0			wash water drains to ditch
	1.495	31	31	3	2	0	0	31	0		2002	125	0	20	1		pumped for the first time
	3.504	18	5	3	3	1	0	18	0		never		0	5			
	0.736	26	1	3	3	1	0	26	0		unk		0	0	1		
	0.194	45	45	4	3	0	0	45	0		2001	125	0	15	1		pumped every three years
	4.727	54	54	4	6	0	0	0	0		never		0	0	1		NO SEPTIC TANK
	0.240	36	36	4	4	0	0	36	0		2004	195	0	1			pumped every two years
	0.217	39	39	3	2	1	0	39	0		never		0	0			
	1.013	40	40	3	3	0	0	40	0		2004	100	0	0			pumped as needed
	0.536	23	23	4	3	1	0	23	0		never		0	1			
	0.785	60	10	4	1	0	0	40	0		never		0	20			wash water drains to ditch
	2.013	15	15	4	7	1	0	15	0		2002	125	0	10			
	1.116	48	31	6	2	0	0	31	0		never		0	1			
	0.817	20	20	3	6	0	0	20	0		never		0	20	1		
	0.947	44	44	6	2	0	0	5	1		never		0	0	1		new drain field & tank
	0.985	20	20	3	6	0	0	20	0		2002	200	0	10	1		wash water drains to field
	3.966	34	34	4	2	0	0	34	0		2003	92	1	1	1		pumped every 4 to 5 years
	0.874	6	6	4	7	0	1	6	0		never		0	5			
	1.516	52	48	6	1	0	0	15	1	1890	2003	100	0	0			new tank after Hugo
	1.559	50	4	2	2	1	0	28	0	20+	2004	100	0	5			pumped every two years
	0.149	49	4	4	2	1	0	40	0		2003	100	0	0			tank pumped as needed
	2.377	2	2	4	4	1	1	2	0		never		0	0			
	0.460	44	15	2	1	0	0	40	0		2004	unk	0	0			tank pumped as needed
	1.209	8	8	4	4	0	1	8	0		2001	unk	0	0	1		wash water drains to yard
	0.821	60	60	4	2	1	0	40	1	1500	2002	100	0	5			rep. drainfield, pump every yr
	0.488	23	23	3	1	1	0	23	0		2002	100	0	5			tank pumped every two years
	0.482	54	54	4	1	1	0	40	0		1996	unk	0	15			
	1.771	8	8	4	4	1	0	8	0		never		0	0	1		
	0.650	20	20	3	1	0	0	5	1		never		0	0			system replaced

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	7.748	84	2	5	3	0	0	5	0		never		0	20			wash water drains to field
	4.470	10	19	6	2	1	0	10	0		never		0	10			
	0.866	11	11	4	3	1	0	11	0		2001	unk	0		1		tank pumped every 3 years
	1.833	23	20	4	3	0	0	23	0		1999	100	0	20			smell, pump every 5 yrs
	2.181	28	28	4	4	1	0	28	0		1999	unk	1	20	1		tank pumped every 5 years
	0.586	40	40	3	1	0	0	40	0		1989	unk	1	5			water softener doesn't work
	1.877	15	15	3	1	1	0	15	0		2001	100	0	5			tank pumped every 3 years
	0.798	44	10	5	1	0	0	20	0		unk		0	1			
	1.078	44	44	3	1	1	0	44	1		1995	unk	0	15	1		new drain field
	1.071	78	42	4	3	1	0	42	0		1994	200	0	0			
	3.443	14	14	2	2	0	0	14	0		never		0	0			
	0.489	54	54	3	3	0	0	40	1	150	2001	unk	0	1			new tank lid, pump every 2 yrs
	0.478	69	50	6	2	0	0	40	0		1999	100	0	1			wash water drains to woods
	0.561	14	3	2	1	1	0	14	0		2003	120	0	1			pumped as needed
	3.443	21	21	3	3	1	0	21	0		never		0	10	1		
	1.655	30	18	5	3	0	0	15	0		2003	95	0	15			system replaced after Hugo
	0.988	59	56	3	3	0	0	5	0		never		0				system replaced 5 years ago
	0.972	20	20	3	4	1	0	10	0		never		0	0	1		
	1.030	7	3	3	2	1	0	7	0		2001		0	0	1		
	1.343	22	22	4	1	1	0	22	0		never		0	1			
	0.931	48	48	5	2	0	0	48	0		2001	100	0	5			system pumped every 5 years
	0.765	2	2	1	1	0	0	2	0		never		0	0		1	
	1.106	25	25	3	3	0	0	25	0		2000	unk	0	1			
	6.786	6	6	2	5	0	0	6	0		2000	100	0	15			wash water drains to field
	10.560	5	5	4	6	1	0	5	0		never		0	5			
	0.353	27	27	3	2	1	0	27	1		2002	unk	0	15			new tank lid, pumped as need
	0.812	29	29	3	2	1	0	29	0		2002	100	0	5			
	3.438	20	20	4	3	0	0	20	0		never		0	1	1		wash water drains to field
	1.954	27	16	4	7	1	0	16	0		never		0	0			
	1.076	44	4	4	6	1	0	4	0		never		0	0			
	2.301	18	18	5	4	1	0	18	0		2004	150	0	1			tank pumped every six months
	0.443	20	20	3	3	1	0	20	0		2002	100	0	0			tank pumped every three years
	2.006	17	17	3	4	1	0	17	0		never		0	1			
	0.993	2	2	3	3	1	0	2	0		never	unk	0	0			
	2.695	12	9	3	2	1	0	12	0		2004	unk	0	1			tank pumped every six months
	2.046	12	12	3	1	1	0	12	1	1350	never		1	1			system replaced 12 years ago

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	1.024	12	7	5	4	1	0	12	0		never		0	20			
	2.264	4	4	4	5	1	0	4	1	800	2004	unk	0	10			new drain, tank pumped yearly
	1.339	18	18	3	3	1	0	18	1		never		1	10			replaced drainfield lines
	0.750	9	9	3	3	1	0	9	0		never		0	5			
	3.167	5	5	3	1	1	0	5	0		never		0	0			
	1.492	10	10	3	1	0	0	10	0		2002	100	0	0			wash water drains to field
	0.384	104	65	5	1	0	0	40	0		1999	unk	0	0			pumped every 5 years
	1.155	14	14	3	3	1	0	14	0		1998	unk	0	5			
	37.095	5	5	3	4	1	0	5	0		never		1	0	1		
	1.143	14	14	4	2	1	0	14	1		never		1	0	1		clean drain line
	1.629	20	20	3	3	1	0	20	0		2003	100	1	0			hot tub, tank pumped yearly
	0.725	7	7	5	6	1	0	7	0		never		0	15			
	8.461	8	8	2	2	1	1	8	0		never		1	0	1	1	
	0.506	84	40	3	3	0	0	40	0		1999	198	0	0			wash water drains to field
	2.568	29	29	4	1	1	0	29	0		1998	100	1	0			
	1.229	22	22	3	2	0	0	22	0		2001	95	1	20			sewerage backups
	0.863	65	65	5	2	1	0	40	0		1998	unk	1	5			
	1.750	3	3	3	4	1	0	3	0		never		0	20		1	
	0.739	37	29	5	4	1	0	29	0		2003	125	0	5			tank pumped every five years
	2.052	31	31	4	2	0	0	31	0		2001	100	1	5			wash water drains to ditch
	2.218	41	41	3	1	1	0	41	0		2002	100	0	5	1		hot tub, tank pumped as needed
	1.014	51	51	4	6	1	1	40	0		never		0	5	1		hot tub connected to septic
	1.000	21	21	3	5	0	0	21	0		never		0	10			
	0.938	11	9	3	1	1	0	11	0		2003	89	1	20	1		
	0.979	18	18	3	2	0	0	18	0		unk		0	5			
	1.307	25	25	3	5	0	0	25	0		2004	90	0	20			tank pumped once a year
	0.864	44	20	3	3	0	0	20	0		1998	125	0	5	1		pumped every 6 - 7 years
	0.888	11	20	3	3	1	0	11	0		1998	125	0	5			
	0.906	8	8	3	3	1	1	8	0		2001	100	0	10			pumped every 3 - 4 years
	1.033	7	7	2	3	1	0	7	0		never		0	15			
	0.999	20	20	4	2	0	0	20	0		2001	80	0	20			no washing machine
	0.843	11	10	3	3	1	0	11	0		2004	110	0	20			pumped every 6 months
	3.077	74	24	5	1	0	0	24	0		never		0	5	1		wash water drains to field
	3.878	64	64	3	1	1	0	40	0		never		0	1	1		
	1.213	65	57	8	2	0	0	40	0		2003	105	0	6			wash water drains behind house
	2.000	32	32	4	1	0	0	32	0		unk		0	1	1		wash water drains behind house

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	1.297	25	20	2	1	1	0	20	0		2003	130	0	0			
	2.834	10	10	3	1	0	0	10	0		never		0	1	1		
	4.751	12	2	2	4	1	0	12	0		unk		0	0			
	0.898	22	22	4	1	1	0	22	0		2004	0	0	1	1		pumped every 2 to 3 months
	0.978	7	7	3	1	1	0	7	0		unk	100	0	1			tank pumped as needed
	0.234	49	49	3	2	0	0	49	0		never		0	5		1	wash water drains to field
	0.455	8	8	3	2	1	0	8	0		never		0	5	1		
	0.568	33	33	3	1	1	0	33	0		never		0	1			
	0.705	34	34	3	2	0	0	34	0		never		0	1			no washing machine
	0.772	54	54	8	4	0	0	40	0		1995	unk	0	1			wash water drains to ditch
	1.910	8	6	3	4	1	0	8	0		never		0	10			
	3.685	14	14	4	4	1	0	14	0		2002	110	0	1			pumped every 4 years
	0.919	30	30	3	2	0	0	30	0		1989	0	1	1			pumped after Hugo
	0.918	31	31	4	2	0	0	31	0		never		0	1			wash water drains to field
	0.915	15	15	3	2	1	0	15	0		2000	110	0	0			
	0.567	19	7	3	2	0	0	19	0		never		0	10			
	1.702	30	30	4	4	0	0	30	0		2003	unk	0	1			pumped every two years
	0.793	20	20	4	2	1	0	20	0		never		0	1	1		
	2.284	5	5	4	4	1	0	5	0		never		0	5	1		hot tub drains to septic system
	3.355	32	30	4	1	1	0	30	0		never		1	1			
	3.467	8	8	2	1	1	0	8	0		never		0	0	1		
	1.150	11	11	3	3	1	0	11	0		never		0	20			
	1.215	48	48	4	1	0	0	48	0		never		0	1	1		wash water drains to field
	1.285	54	49	4	4	0	0	49	0		2003	unk	0	0			
	1.102	3	3	3	6	1	0	3	0		never		0	1			
	1.986	45	45	4	2	1	0	45	0		1994	unk	0	10			
	3.997	54	29	3	2	1	0	29	0		2004	120	0	1			pumped once a year
	1.005	34	34	4	2	0	0	34	1		unk	unk	0	0			repaired drain field
	0.343	16	16	3	1	0	0	16	0		2004	free	1	1	1		sewerage back-ups & smell
	0.314	54	42	4	1	1	0	42	0		unk		0	0	1		
	1.513	1	1	4	6	1	0	1	0		never		0	5			
	3.874	53	53	3	2	1	0	40	0		2003	112	0	1			
	1.902	1	1	3	4	1	0	1	0		never		0	1			
	3.373	12	12	5	10	1	0	12	0		never		0	1			
	103.709	12	12	2	1	1	0	12	0		never		0	0			
	0.799	2	2	3	5	0	0	2	0		never		0	1			

	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	PROBLEMS
	0.880	17	4	3	3	1	0	5	0		never		0	1			new system installed f1999
	1.050	5	5	3	2	1	0	5	0		2004	free	0	1			
	1.092	3	3	3	2	1	0	3	0		never		0	5	1		hot tub
	1.824	16	16	3	3	1	0	16	0		unk		0	1			
	1.114	28	28	5	4	0	0	28	0		never		1	0			hot tub, wash water to ditch
	0.809	10	10	3	2	1	0	10	0		never		0	20	1		
	0.660	30	30	4	1	1	0	30	0		never		0	1			
	0.660	10	6	4	2	1	0	10	0		2003	100	1	10			hot tub, pump out once a year
	1.527	15	15	2	2	1	0	15	0		never		0	5			
	2.360	15	15	3	1	1	0	15	0		never		0	1			hot tub
	0.911	4	4	4	5	1	0	4	0		never		0	1			hot tub
	0.743	8	8	3	4	1	0	8	0		2004	100	0	20	1		pump tank once a year
	23.371	14	14	3	2	1	0	14	0		never		0	1			
	14.387	18	5	1	1	0	0	18	0		never		0	20	1		wash water drains to dry well
	ACRES	AGE	YRS	BEDS	OCC	WASH	DISP	AGE	REP	COST	PUMP	COST	SOFT	WWU	TOTL	FECAL	
mean	2.86	39	21	4	3			28		810		131		5			
max	103.71	104	79	10	8			51		2300		250		20			
min	0.15	1	1	1	1			1		100		0		0			
stdev	7.49	45	26	1	2			30		606		78		7			
count	303.00	303	303	303	303	187	13	303	21	68	130	118	50	303	98	6	
percent						62	4		7	3	43	39	17		33	6	

WWU
90 oppose, 29.7%
210 favor, 69.3%
3 undecided, 1%

ACRES: Parcel size in acres
AGE: Age of home
YEARS: Number of years in residence
BEDS: Number of bedrooms
OCC: Number of occupants
WASH: Washing machine drain connected to septic tank, 1=Yes, 0=No
DISP: Garbage disposal in kitchen sink
AGE: Age of septic system

REP: Septic system repairs, 1=Yes, 0=No
COST: Cost of repairs
SOFT: Water softener. 1=Yes. 0=No
WWU: Support a wastewater management system, $ amount
TOTL: 1=total coliform bacte coliform bacteria
FECAL: 1=fecal coliform bacteria present

Appendix C

Septic System Evaluations

SEWEE to SANTEE > SEPTIC SYSTEM SURVEY

Inspections Performed December, 2004 through January, 2005

SITE NUMBER	**SOIL CONDITION (See Soil Condition Index)**	**PROBLEMS**	**RECOMMENDCATIONS REPAIRS NEEDED**
Highest Priority Sites			
H1S	**MODERATE**	System failing and discharging around tank. Tank full of water. Water in tank blue-green color. Could only locate approximately 30 ft of field lines.	Entire system needs to be replaced: 1,000 gallon tank plus 225 ft of shallow placement, 6" aggregate field lines. * Refrain from disposing any cleaners / disinfectants, or other chemicals into the septic tank system.
H2S	**LIMITED**	Tank has dirt bottom. Tank completely full of water.	Replace tank and add a minimum of 100 ft additional field lines.
H3S	**MODERATE**	**Two sections of lid cracked.**	Replace lid.
H4S	**LIMITED**	Overflow pipe from field lines into wooded area.	Relocate drain field to more suitable area. Install an ultra-shallow placement system with 12 inches of fill material. Disconnect present overflow.
H5S	**GOOD**	Well only 30 ft away from septic tank system. Tank lid is cracked. Tank completely full of water. Washing machine discharge to ground surface.	Relocate well at least 50 ft from septic system. Repair/replace tank lid. Install minimum 100 ft of additional field lines. Connect washing machine plumbing into septic tank.
H6S	**GOOD**	Washing machine discharge to ground surface. Septic tank is very small. Unable to locate any drain field.	Replace tank. Install 150 ft of conventional field lines. Connect washing machine plumbing into septic tank.
H7S	**MODERATE**	Washing machine discharge to ground surface.	Connect washing machine plumbing into septic tank.
H8S	**SEVERE**	Septic tank very small. Washing machine discharge to ground surface.	Replace tank. Connect washing machine plumbing into septic tank. Install minimum 100 ft additional shallow placement, 6" aggregate field lines.
Continued on next page…			

Highest Priority Sites, Continued	**Soil Condition (See Soil Condition Index)**	**PROBLEMS**	**<u>RECOMMENDATIONS</u> REPAIRS NEEDED**
H9S	**LIMITED**	Washing machine discharge to ground surface. Baby wipes and other sanitary items found in tank. Considerable amount of solids found in tank. Driving over field lines.	Connect washing machine plumbing into septic tank. Discard baby wipes and other sanitary items into garbage. Pump-out tank every 3 – 5 years. Install barricade to prevent driving over field lines.
H10S	**GOOD**	Washing machine discharge to ground surface. Water level in tank above outlet invert. Outlet Tee too deep.	Connect washing machine plumbing into septic tank. Install 100 ft conventional field lines. Repair outlet Tee.
H11S	**LIMITED**	Water level in tank above outlet invert. Effluent being discharged around tank area.	Recommendation = Replace system with an ultra-shallow placement system with 12 inches of fill material. Minimum Repair = Install 100 ft shallow placement, 6” aggregate field lines.
H12S	**LIMITED**	Well only 23 ft from septic tank system.	Relocate well at least 50 ft from septic system.
H13S	**GOOD**	Well only 35 ft from septic tank system.	Relocate well at least 50 ft from septic system.
Medium Priority Sites	**Soil Condition (See Soil Condition Index)**	**PROBLEMS**	**<u>RECOMMENDCATIONS</u> REPAIRS NEEDED**
M1S	**LIMITED**	Tank capacity too small. No grease trap present.	Commercial Establishment: Contact local DHEC office for recommended septic tank capacities and grease trap requirements for this type of facility.
M2S	**MODERATE**	Water level in tank above outlet invert.	Install 100 ft shallow placement, 6” aggregate field lines.
M3S	**MODERATE**	Tank appears unlevel. Water level in tank above outlet invert.	Tank needs to be leveled. Install 100 ft shallow placement, 6” aggregate field lines.
M4S	**MODERATE**	Water level in tank above outlet invert.	Install 100 ft shallow placement, 6” aggregate field lines.
M5S	**MODERATE**	Water level in tank above outlet invert. Wastewater pump is not working properly.	Repair/replace wastewater pump.
Continued, next page…			

Medium Priority Sites, Continued	**Soil Condition (See Soil Condition Index)**	**PROBLEMS**	**<u>RECOMMENDATIONS</u> REPAIRS NEEDED**
M6S	**LIMITED**	Parking on part of the septic system. Float levels may not be optimally positioned.	Install barricade to prevent parking on system. Have contractor or local DHEC office to examine float levels and adjust them if warranted.
M7S	**LIMITED**	Water leveling tank above outlet invert. Sludge layer greater than 18".	Install 100 ft shallow placement, 6" aggregate field lines. Have tank pumped-out every 3 – 5 years.
M8S	**LIMITED**	Inlet pipe appears to be up-hill. Water level in tank above outlet invert.	Have plumber check inlet pipe for proper grade. Install 100 ft shallow placement, 6" aggregate field lines.
M9S	**GOOD**	Water level in tank above outlet invert.	Install 100 ft conventional field lines.
M10S	**MODERATE**	Water level in tank above outlet invert.	Install 100 ft shallow placement, 6" aggregate field lines.
M11S	**GOOD**	Unable to access tank due to solid lid. Only 20 ft of field lines could be found.	Have pumper install access port on tank, and perform pump-out. Additional 100 ft of conventional field lines may be needed.
Lowest Priority Sites	**Soil Condition (See Soil Condition Index)**	**PROBLEMS**	**<u>RECOMMENDCATIONS</u> REPAIRS NEEDED**
L1S	**MODERATE**	No signs of septic system failure.	No Recommendations.
L2S	**GOOD**	No signs of septic system failure.	No Recommendations.
L3S	**LIMITED**	No signs of septic system failure.	No Recommendations.
L4S	**SEVERE**	Marginal soils found for septic tank system. No signs of septic system failure.	No Recommendations.
L5S	**MODERATE**	No signs of septic system failure.	No Recommendations.
L6S	**LIMITED**	Scum layer 12" thick in tank. No signs of septic system failure.	Pump-out tank every 3 - 5 years.
L7S	**LIMITED**	Driving over septic system. No signs of septic system failure.	Install barricade to prevent driving over system.
Continued on next page…			

Lowest Priority Sites, Continued	Soil Condition (See Soil Condition Index)	PROBLEMS	RECOMMENDATIONS REPAIRS NEEDED
L8S	**LIMITED**	Gaps found between tank lid sections. No signs of septic system failure.	Close gaps between tank lid sections.
L9S	**MODERATE**	No signs of septic system failure.	No Recommendations.
L10S	**LIMITED**	No signs of septic system failure.	No Recommendations.
L11S	**LIMITED**	Driving over septic system. No signs of septic system failure.	Install barricade to prevent driving over system.
L12S	**LIMITED**	No signs of septic system failure.	No Recommendations.
L13S	**LIMITED**	Marginal soils found for septic tank system. No signs of septic system failure.	No Recommendations.
L14S	**GOOD**	No signs of septic system failure.	No Recommendations.
L15S	**SEVERE**	No signs of septic system failure.	No Recommendations.
L16S	**SEVERE**	No signs of septic system failure.	No Recommendations.
L17S	**LIMITED**	Scum layer 12” thick in tank. No signs of septic system failure.	Pump-out tank every 3 - 5 years.
L18S	**MODERATE**	Only 2 to 6 inches of cover over field lines. No signs of septic system failure.	Add 4 to 8 inches of fill material over field line area.

SOIL CONTION INDEX

SOIL CONDITION	EXPLANATION
GOOD	Sites that would likely support a conventional type septic tank system
MODERATE	Sites that would likely support an alternative septic tank system
LIMITED	Sites that would likely support an alternative system, but would require extensive site modifications such as adding fill material
SEVERE	Sites that would be considered either unsuitable or would require an innovative/experimental septic tank system

Appendix D

Soil Borings

SEWEE to SANTEE > SOIL BORINGS

SITE	DEPTH	COLOR	CLASS	INDICATORS/COMMENTS
	(Inches)			(SHWT = Seasonal High Water Table)
H1S	0-12	Dark Brown	II	
	12-24	Yellow Brown	II	
	24-28	Yellow Brown	II	Gray Brown and Red Mottles (SHWT 24”)
	28-36	Gray Brown	II	Pale Brown Mottles
H2S	0-10	Dark Gray Brown	II	
	10-16	Pale Brown	II	
	16-18	Pale Brown	II	Red Mottles
	18-20	Pale Brown	II	Gray and Gray Brown Mottles (SHWT 18”)
	20-28	Gray Brown	II	
	28-36	Yellow Brown	I	Gray and Red Mottles (Saturated)
H3S	0-6	Very Dark Gray	II	
	6-12	Dark Brown	II	
	12-18	Yellow Brown	II	
	18-24	Yellow Brown	II	Red and Pale Brown Mottles
	24-36	Pale Brown	II	Gray and Red Mottles (SHWT 24”)
H4S	0-14	Black	II	
	14-30	Gray Brown	III	Gray Mottles (SHWT less than 14”)
	0-8	Black	II	
	8-12	Gray Brown	II	
	12-18	Pale Brown	II	Gray and Red Mottles (SHWT less than 12”)
	18-30	Gray	II	Yellow Brown Mottles
H5S	0-8	Gray Brown	I	
	8-24	Yellow Brown	I	
	24-36	Strong Yellow Brown	II	(SHWT greater than 36”)
H6S	0-8	Dark Gray Brown	II	
	8-30	Pale Brown	II	
	30-32	Pale Brown	II	Red Mottles
	32-40	Pale Brown	II	Gray and Red Mottles (SHWT 32”)
H7S	0-6	Dark Gray Brown	II	
	6-20	Yellow Brown	II	
	20-24	Brown	II	
	24-30	Brown	II	Gray Brown and Gray Mottles (SHWT 24”)
	30-36	Gray Brown	II	Gray and Red Mottles
	0-8	Dark Gray Brown	II	
	8-18	Pale Brown	II	
	18-23	Pale Brown	II	Red and Dark Brown Mottles
	23-36	Pale Brown	II	Red, Dark Brown and Gray Mottles (SHWT 23”)

H8S	0-12	Very Dark Gray	II	
	12-30	Dark Gray Brown	II	SHWT less than 12” and Saturated at 10”
H9S	0-5	Very Dark Gray	II	
	5-8	Dark Brown	II	
	8-16	Pale Brown	II	Gray Brown Mottles
	16-22	Pale Brown	II	Gray, Red, and Gray Brown Mottles (SHWT 16”)
	22-30	Gray Brown	II	Gray and Red Mottles and Saturated
	30-36	Brown	I	Gray and Red Mottles
H10S	0-8	Gray Brown	II	
	8-40	Pale Yellow	II	SHWT greater than 40”
	0-8	Gray Brown	II	
	8-36	Yellow Brown	II	
	36-40	Yellow Brown	II	White and Pale Brown Mottles (SHWT 36”)
H11S	0-8	Dark Gray Brown	II	
	8-15	Yellow Brown	II	Pale Brown Mottles
	15-18	Pale Brown	II	Gray Brown, Red, and Yellow Brown Mottles (SHWT 15”)
	18-26	Dark Brown	II	
	26-36	Yellow Brown	I	Gray and Red Mottles
	0-6	Dark Gray Brown	II	
	6-18	Pale Yellow Brown	II	
	18-22	Pale Brown	II	Gray and Red Mottles (SHWT 18”)
	22-36	Dark Brown	II	
H12S	0-10	Very Dark Gray	II	
	10-16	Dark Gray Brown	II	
	16-22	Pale Brown	II	Gray and Gray Brown Mottles (SHWT 16”)
	22-28	Light Gray	I	Yellow Brown and Gray Brown Mottles
	28-36	Gray	II	Yellow Brown Mottles
H13S	0-8	Dark Gray Brown	II	
	8-24	Pale Brown	II	
	24-30	Yellow Brown	II	
	30-36	Pale Brown	I	Gray and Red Mottles (SHWT greater than 30”)
M1S	0-6	Brown & Black	II	Fill Material
	6-12	Dark Gray Brown	II	
	12-30	Pale Brown	II	Gray and Red Mottles (SHWT 12”)
	30-36	Gray Brown	II	Gray and Yellow Brown Mottles
	0-8	Dark Gray Brown	II	
	8-16	Pale Brown	II	
	16-21	Pale Brown	II	Red Mottles
	21-30	Yellow Brown	II	Red, Gray and Pale Brown Mottles (SHWT 21”)
	30-36	Pale Brown	I	Gray and Red Mottles

M2S	0-10	Dark Gray Brown	II	
	10-20	Yellow Brown	II	
	20-24	Yellow Brown	II	Pale Brown and Red Mottles
	24-36	Pale Brown	II	Gray and Red Mottles (SHWT 24")
M3S	0-8	Dark Gray Brown	II	
	8-12	Dark Gray Brown	II	
	12-24	Pale Yellow Brown	II	
	24-36	Pale Brown	II	Red Mottles
	26-30	Yellow Brown	II	Red and Gray Mottles (SHWT 26")
M4S	0-6	Gray Brown	II	
	6-30	Pale Yellow Brown	I	
	30-36	Pale Yellow	I	Red Mottles (SHWT greater than 36")
	0-6	Gray Brown	II	
	6-16	Pale Brown	II	Gray and Red Mottles (SHWT 6")
	16-20	Gray	III	Yellow Brown Mottles
	20-36	Gray	II	Yellow Brown Mottles
M5S	0-10	Gray Brown	II	
	10-22	Pale Brown	II	
	22-24	Pale Brown	II	Gray Brown and Gray Mottles (SHWT 22")
	24-36	Gray Brown	II	
M6S	0-8	Very Dark Gray	II	
	8-14	Pale Gray Brown	II	
	14-20	Pale Brown	II	Red and Gray Mottles (SHWT less than 14")
	20-36	Gray Brown	II	Gray and Yellow Brown Mottles
M7S	0-8	Dark Gray Brown	II	
	8-12	Pale Brown	II	
	12-16	Pale Brown	II	Red Mottles
	16-22	Pale Brown	II	Gray and Red Mottles (SHWT 16")
	22-36	Gray Brown	II	Gray and Red Mottles
M8S	0-10	Very Dark Gray	II	
	10-16	Pale Brown	II	
	16-20	Pale Brown	II	Gray and Gray Brown Mottles (SHWT 16")
	20-36	Gray Brown	II	Dark Brown and Gray Mottles
M9S	0-10	Brown	II	
	10-24	Yellow Brown	II	
	24-32	Yellow Brown	III	
	32-36	Yellow Brown	III	Gray and Red Mottles (SHWT 32")
M10S	0-6	Gray Brown	II	
	6-14	Pale Brown	II	
	14-24	Red Brown	III	
	24-36	Red Brown	III	Gray and Yellow Brown Mottles (SHWT 24")

M10S				(Continued)
	0-5	Gray Brown	II	
	5-12	Pale Brown	II	
	12-18	Red Brown	III	
	18-30	Red Brown	IV	Gray, Yellow Brown & Red Mottles (SHWT 18”)
	30-36	Red Brown	III	Gray, Red and Yellow Mottles
M11S	0-6	Gray Brown	II	
	6-12	Light Brown	I	
	12-22	Yellow Brown	I	
	22-36	Strong Yellow Brown	III	
	36-38	Strong Yellow Brown	III	Pale Brown Mottles (SHWT greater than 36”)
L1S	0-8	Brown	II	
	8-16	Pale Brown	II	
	16-28	Yellow Brown	III	
	28-36	Yellow Brown	III	Gray and Red Mottles (SHWT 28”)
L2S	0-8	Dark Gray Brown	I	
	8-18	Pale Brown	I	
	18-30	Brown	I	Pale Brown Mottles
	30-36	Yellow Brown	I	
	36-42	Yellow Brown	I	Pale Brown and Gray Mottles (SHWT 36”)
	0-6	Gray Brown	I	
	6-10	Very Pale Brown	I	
	10-28	Pale Brown	I	
	28-36	Gray Brown	I	Gray and Pale Brown Mottles (SHWT 28”)
L3S	0-8	Dark Gray	II	
	8-16	Pale Brown	II	
	16-22	Pale Brown	II	Gray and Red Mottles (SHWT 16”)
	22-36	Gray	III	Red and Yellow Brown
	0-6	Dark Gray	II	
	6-10	Pale Gray Brown	II	
	10-18	Pale Brown	II	
	18-36	Pale Brown	II	Gray and Red Mottles (SHWT 18”)
L4S	0-6	Gray Brown	II	
	6-10	Pale Yellow Brown	II	
	10-20	Black	II	SHWT 10”
	20-30	Gray	I	Saturated
L5S	0-8	Dark Brown	II	
	8-21	Yellow Brown	II	
	21-24	Pale Brown	II	Gray and Gray Brown Mottles (SHWT 21”)
	24-36	Gray Brown	II	Yellow Brown, Gray and Pale Brown Mottles

L6S	0-8	Dark Gray Brown	II	
	8-12	Dark Brown	II	
	12-14	Pale Brown	II	
	14-26	Pale Brown	II	Gray and Red Mottles (SHWT 14’)
	26-36	Yellow Brown	I	Gray and Red Mottles
L7S	0-2	Gray Brown	II	
	2-16	Pale Brown	II	
	16-20	Pale Brown	II	Gray Brown and Red Mottles (SHWT 16”)
	20-36	Dark Gray Brown	II	Saturated at 26”
L8S	0-10	Dark Gray Brown	II	
	10-16	Pale Brown	II	
	16-30	Pale Brown	II	Gray Brown and Gray Mottles (SHWT 16”)
L9S	0-6	Brown	II	
	6-18	Yellow Brown	II	
	18-24	Yellow Brown	II	Red Mottles
	24-36	Yellow Brown	II	Red and Gray Mottles (SHWT 24”)
L10S	0-6	Dark Brown	II	
	6-21	Yellow Brown	II	
	21-24	Yellow Brown	II	Gray, Red and Gray Brown Mottles (SHWT 21”)
	24-36	Gray Brown	II	Gray and Yellow Brown Mottles
	0-8	Dark Brown	II	
	8-18	Pale Brown	II	
	18-22	Gray Brown	II	SHWT 18”
	22-36	Pale Yellow Brown	I	Gray and Red Mottles
L11S	0-10	Dark Brown	II	
	10-19	Pale Brown	II	
	19-21	Pale Brown	II	Gray Brown Mottles (SHWT 19”)
	21-26	Gray Brown	II	
	26-36	Dark Brown	II	Red and Gray Brown Mottles
L12S	0-10	Dark Gray Brown	II	
	10-18	Pale Brown	II	
	18-23	Pale Brown	II	Gray Brown and Gray Mottles (SHWT 18”)
	23-30	Gray Brown	II	Red and Gray Mottles
	30-36	Pale Brown	I	Red and Gray Mottles and Saturated
L13S	0-8	Dark Gray	II	
	8-14	Pale Brown	II	
	14-20	Pale Brown	III	Red and Gray Mottles (SHWT 14”)
	20-36	Gray	IV	Red and Yellow Brown Mottles
L14S	0-8	Dark Brown	II	
	8-28	Yellow Brown	II	
	28-32	Pale Yellow Brown	I	
	32-36	Pale Yellow Brown	I	Pale Brown and Gray Mottles (SHWT 32”)

L15S	0-6	Very Dark Gray	II	
	6-12	Gray Brown	II	
	12-36	Gray Brown	II	Yellow Brown Mottles (SHWT less than 12”)
L16S	0-8	Black	II	
	8-26	Dark Gray	II	SHWT less than 8” and Saturated
	26-36	Dark Brown	II	Gray and Red Mottles and Saturated
	0-30	Very Dark Gray Brown	II	SHWT less than 12” and Saturated at 16”
	30-36	Pale Brown	I	Saturated
L17S	0-10	Dark Gray Brown	II	
	10-18	Pale Brown	I	
	18-22	Pale Brown	II	Gray, Red and Gray Brown Mottles (SHWT 18”)
	22-36	Gray Brown	II	Saturated at 28:
L18S	0-6	Gray Brown	II	
	6-20	Pale Brown	I	
	20-30	Dark Brown	II	Gray Mottles (SHWT 20”)
	30-36	Dark Gray Brown	I	Gray and Red Mottles
	0-8	Gray Brown	II	
	8-21	Pale Brown	I	
	21-30	Gray Brown	II	Gray Mottles (SHWT 21”)
	30-36	Gray Brown	I	Gray, Yellow Brown and Red Mottles